ELECTRICAL CONSTRUCTION AND MAINTENANCE

FEBRUARY • 1950

49th Year

Estimating

Take-off methods for modern electrical estimating.

Appliances

How 1950 appliance markets are creating new jobs.

Plus

Important features, departments and Readers' Service.

Special Feature

Outstanding Electrical Construction

Electrical features of the great new G.E. turbine plant.

A McGRAW-HILL PUBLICATION

BEFORE YOU INSTALL FLOODLIGHTING

This stadium at Windber, Pennsylvania, is owned by a civic recreational association. Day and night, its facilities are available to all community groups, including the local high schools and industries.

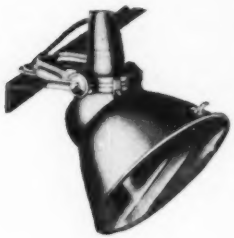
SAVES YOU TIME AND MONEY

You need to do no special engineering or planning when you install lighting jobs like this. The entire installation, of 144 floodlights of 1500-watts each, on six 80-foot steel poles, is covered by one of the standard plans in General Electric's "Manual of Floodlighting Plans."

The plans in this manual cover all types of sports from archery ranges and volley ball courts to 22 complete plans for football and baseball fields. They specify everything to assure a complete lighting job—from the exact location of poles to details on wiring.

With these plans, you can handle jobs like Windber even with no previous floodlighting experience. Such jobs should yield a satisfactory initial profit—and frequently carry with them a year-after-year maintenance contract.

For your copy of "Manual of Floodlighting Plans for Sports and Recreation," write for GET-1284C. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



THE SPORTSLIGHT

This is the floodlight used at Windber Stadium, the G-E Type L-69. It gives more light per unit, more light per watt, is easier to install and cheaper to maintain than any other comparable unit. It's so good that four major-league parks use it, so economical that it's the favorite for sand-lot softball. Bulletin GEC-533 gives complete description and prices.

GENERAL ELECTRIC

451-142

Indoors . . . Outdoors

THE Murray "9600" Meter Connection Box

IS BUILT TO LAST

Dependable, trouble free service is yours with the versatile "All-Service" Murray "9600" Meter Connection Box. Designed to accommodate modern bottom-connected Type A watthour meters, it is eminently satisfactory for either indoor or outdoor mounting. Available in either unpainted aluminum or rust-resisting steel with baked-on gray melamine finish.

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Plenty of hand room is provided in this compact Murray Aluminum Socket. Solderless terminals take up to No. 1 wire. Two types—with or without 1" knockout in back. Cat. No. 1540.

Multiple meter mountings are simplified with this typical Murray Three Gang trough. Similar troughs are available to accommodate two to six meters. Cat. No. 583.

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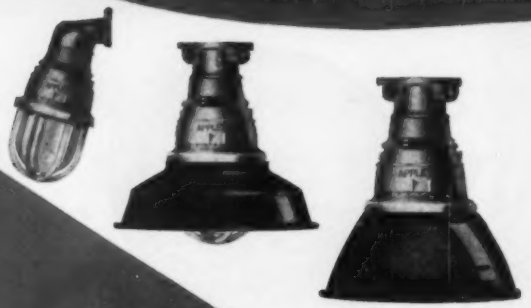

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Gaskets — One Asbestos One Aluminum.
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FEBRUARY — *at a glance* 45

Profit Prospects 47

G. E. of Schenectady 49
By VREELAND FLAGG—Details of the electrical construction work on a new turbine plant, one of the outstanding electrical construction jobs in the United States.

Service Continuity 50

Distribution Methods 52

Grounding and Lighting 54

Construction Techniques 56

How to Estimate Electrical Work II 58
By W. T. STUART—Principles and methods of job visualization and take-off in estimating electrical construction projects.

Bright Outlook for Appliances 60
By ROBERT W. ARMSTRONG—Sales recovery in last six months, intensified promotion, utility help, high national income, potentials of clothes dryers, television, and dishwashers point to a busy 1950.

Simplified Motor Shop Job Control 62
By AUGUST ECKEL—Multiple-copy order forms cut paper work. Order number follows repair job from original entry to number plate on motor; ties in with inventory and parts requisition control at Houston Armature Works.

Reader Service 81

DEPARTMENTS

Motor Shops 69
Practical Methods 75
Product News 83
Catalog and Bulletins 98
Reader's Quiz 101
Questions on the Code 107
Industrial Electrification 113
Modern Lighting 123
In the News 127
Advertiser's Index 140

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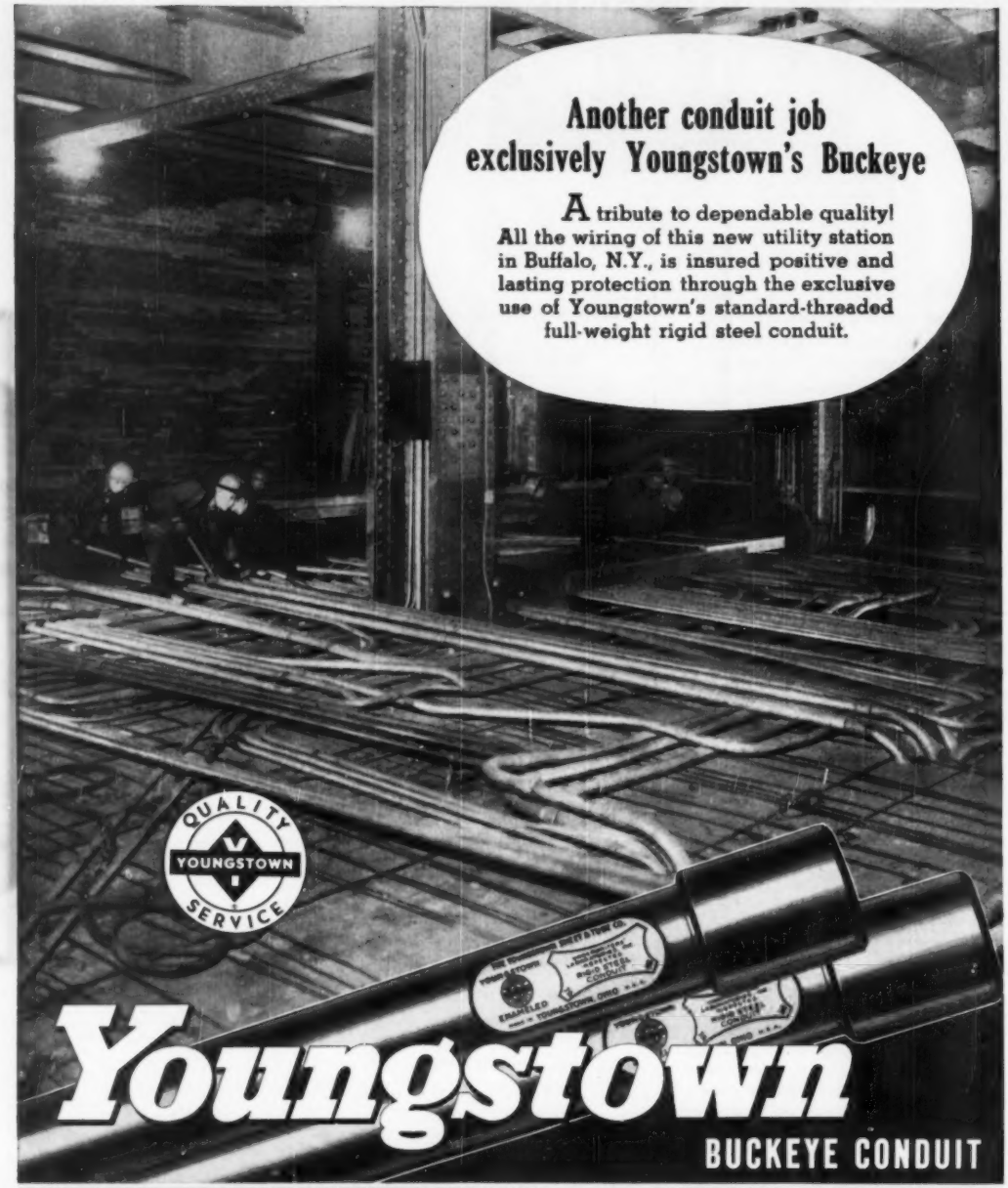
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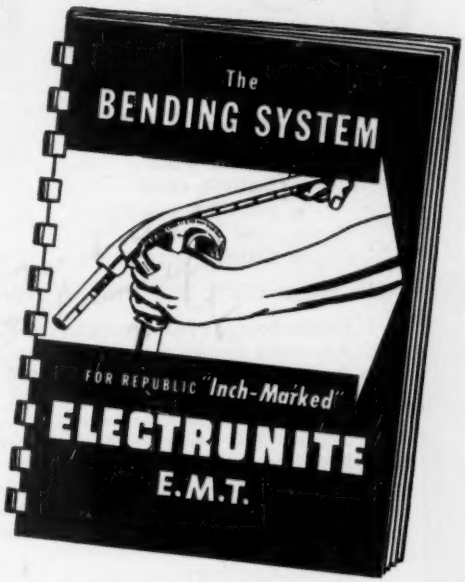

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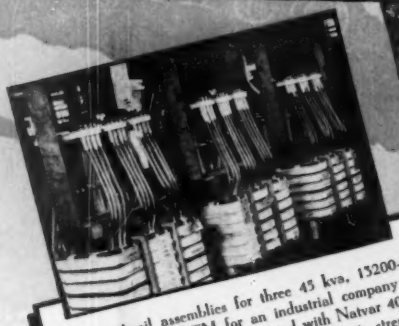

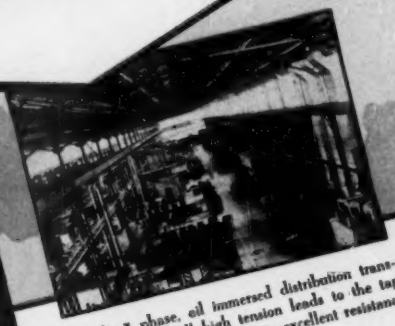

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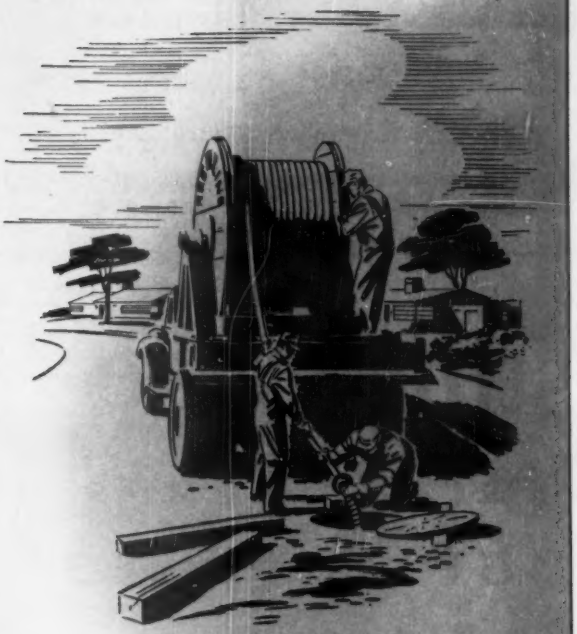

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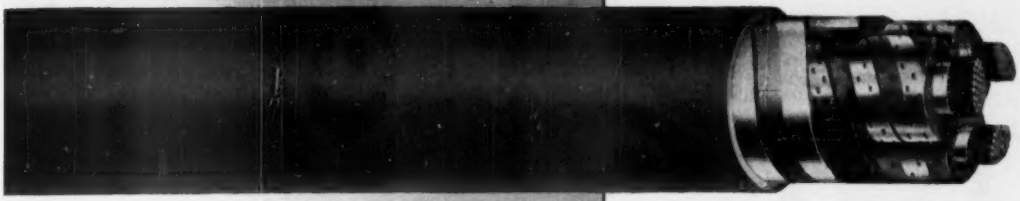

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Westinghouse

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Save Work!

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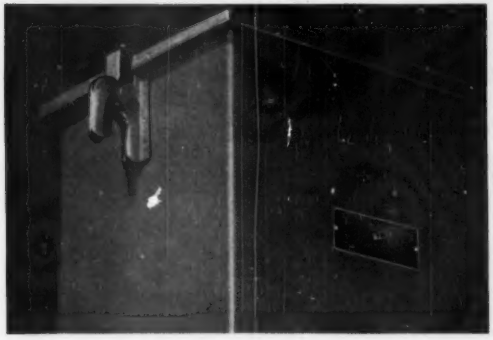
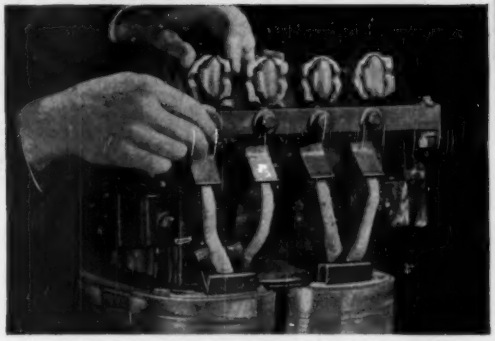


2 Convenient Lifting Hooks for Easy Hoisting!

They're safe too, because they're fabricated steel, not cast. Hooks project well out for easy handling. Rounded edges prevent abrasion of hoist cable.



3 Time-Saving Solderless Clamp Connectors!

This is a standard feature on many popular sizes. (On small sizes, connections are made easily with convenient front and bottom drop out plates.)

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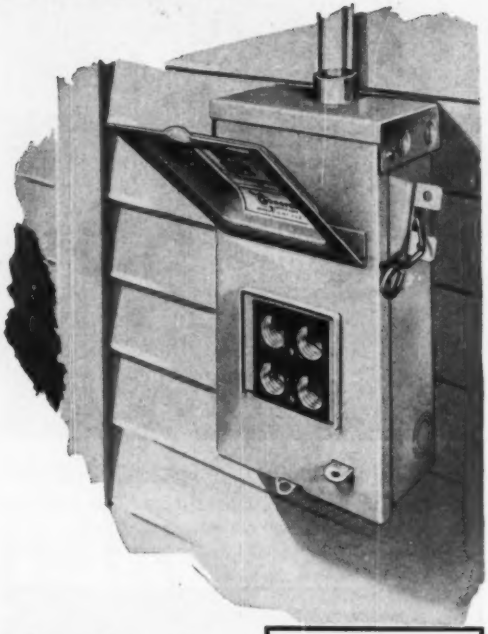
30 to 1200 Amp, HP rated Safety Switches



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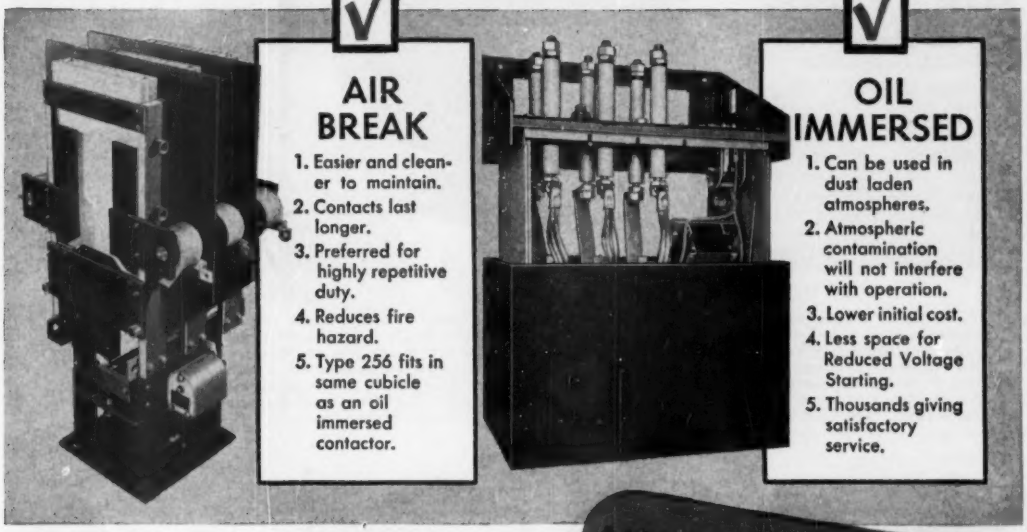

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3. Preferred for highly repetitive duty.
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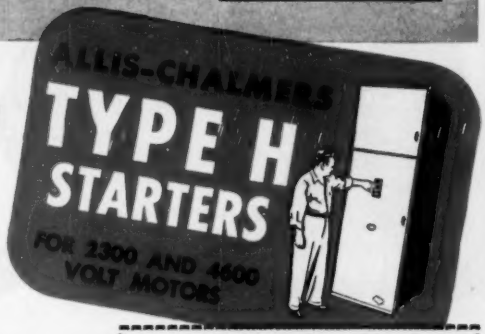
2. Atmospheric contamination will not interfere with operation.
3. Lower initial cost.
4. Less space for Reduced Voltage Starting.
5. Thousands giving satisfactory service.

You can get either in



OIL OR AIR — whichever contactor is best suited to your application can be built into Allis-Chalmers Type *H* Starters. Both are designed for ready access . . . built to give long life with low maintenance. And regardless of the contactor you select, all Allis-Chalmers Type *H* Starters give split-cycle short circuit protection through current limiting fuses.

You get *complete* protection in one attractive, easy to install steel cabinet. Segregated high voltage compartment, enclosed bus bars and safety door interlock protect personnel. Overload and time delay undervoltage devices are coordinated with the contactor to protect motor and equipment.

Choose the starter to fit your needs. For full or reduced-voltage starting, reversing or dynamic braking of squirrel-cage, wound rotor or synchronous motors . . . Allis-Chalmers Type *H* Starters will be your right answer. Call your nearby A-C representative or send coupon today.

ALLIS-CHALMERS

ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.

Please send me more information on Allis-Chalmers Type *H* Starters. ☐ Include bulletin 14B7303 on Type 256 Air Break Contactor.

Name _____

Title _____

Company _____

Address _____

City _____ State _____

A-2926

WAGNER MOTORS *...The choice of leaders in industry*

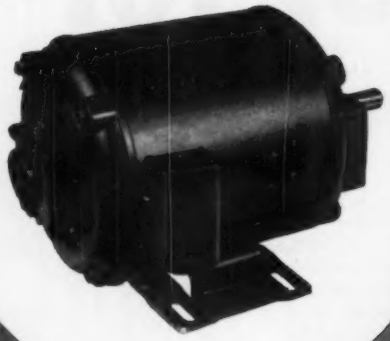
Here's what you get in the WAGNER *Type RA* MOTOR...

the most simplified design to provide—

repulsion start

HIGH STARTING TORQUE . . . for quick, easy starting and smooth acceleration.

LOW STARTING CURRENT . . . to minimize light flicker when motor starts.

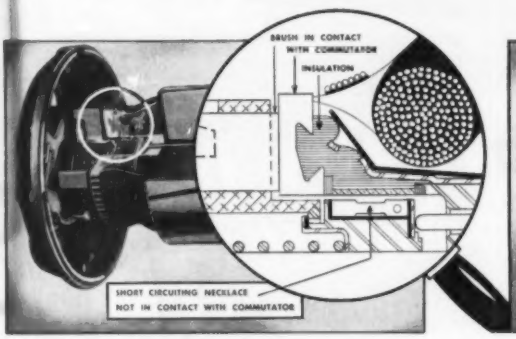


induction run

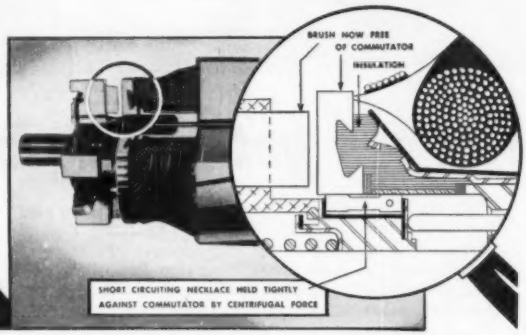
HIGH OPERATING SPEED . . . constant at all operating loads, even under overload.

FLAT EFFICIENCY CURVE . . . over a wide operating range.

Pioneered by Wagner more than half a century ago, the repulsion-start induction single phase motor is truly industry's "general purpose" motor because it combines the best features of two types of motors: the repulsion motor during the starting period and the induction motor while running at rated operating speeds. Today, the Wagner Type RA offers the most simplified, trouble-free design available, and is still the standard by which all other single phase motors are judged. In the Wagner Type RA Motor you get low upkeep cost, minimum servicing, freedom from vibration and noise, and years of reliable service. Shown below are the basic principles of operation of this motor. Bulletin MU-185 gives complete details. Write for a copy.



Starting period—Short-circuiting necklace is not in contact with commutator bars. A governor spring holds barrel in starting position. Brush assembly completes selected circuits enabling motor to start as a repulsion motor.


BRUSH NOW FREE OF COMMUTATOR
INSULATION
SHORT CIRCUITING NECKLACE HELD TIGHTLY AGAINST COMMUTATOR BY CENTRIFUGAL FORCE

Running period—Governor weights (actuating pushrods) have forced spring barrel forward until short-circuiting necklace connects commutator bars to short-circuiting ring, forming a "squirrel cage" to permit operation as an induction motor.

Wagner Electric Corporation EST. 1891

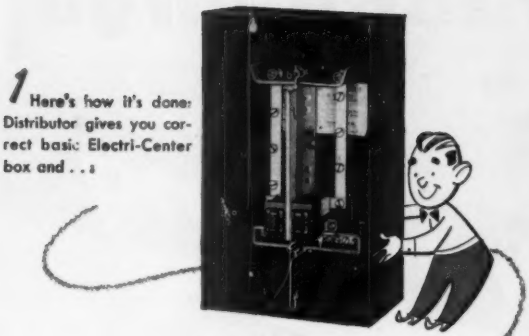
WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS - TRANSFORMERS - INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 29 PRINCIPAL CITIES

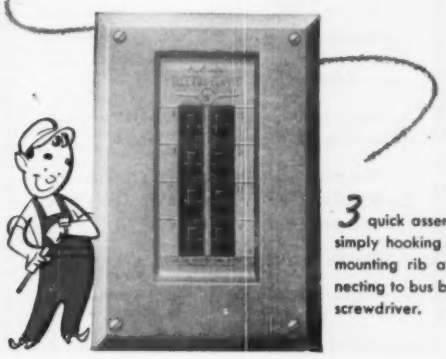
M50-9

Immediate local delivery on any Electri-Center with *Pushmatics*®



1 Here's how it's done: Distributor gives you correct basic Electri-Center box and . . .

2 additional Pushmatics of the desired rating and type from his shelves for . . .



3 quick assembly by simply hooking units on mounting rib and connecting to bus bars with screwdriver.

PUSH—It's ON!

PUSH—It's OFF!

PUSH—It's ON again!

Push-button switch with automatic protection for electric circuits.

PUSHMATIC's amazing flexibility gives you the fastest delivery possible on Electri-Centers to meet your specifications.

Featuring automatic protection and push-button switching, revolutionary Pushmatics are just as easy to order and install as fuses. Individual 1-pole units are easier to add or interchange than multiple units.

There's a Pushmatic to meet every load condition: THERMAL ONLY, THERMAL-MAGNETIC, and THERMAL-MAGNETIC with exclusive AMBIENT COMPENSATING FEATURES. All are identical in size and contour, in ratings of 15, 20, 30, 40 and 50 amperes, 120 V., 1 pole, or 120-240 V., 2 poles, AC. All are interchangeable for rating and type.

Your local BullDog Distributor is standing by to give you immediate delivery on any Electri-Center with Pushmatics. See him soon.

BULLDOG ELECTRIC PRODUCTS COMPANY

DETROIT 32, MICHIGAN • FIELD OFFICES IN ALL PRINCIPAL CITIES

IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO

BULLDOG

HEADQUARTERS FOR ELECTRICAL DISTRIBUTION

"We stopped motor burn-outs and saved time and money for a large company..."

by Installing..

"Recently, while rewiring part of a large manufacturing plant here in Salem, we installed Fusetron dual-element fuses in motor-running protection size to back up the overload protection already installed on the motors.

"On several occasions, for some reason, these protectors failed to operate when they should have and the motor would have burned out except for the opening of the Fusetron fuses.

"The company's plant engineer was so impressed by the way these Fusetron fuses prevented damage to the motors and saved the company time and money that he authorized us to install Fusetron fuses throughout the entire plant."

Howard Firestone. Owner
FIRESTONE ELECTRIC COMPANY,
Salem, Ohio

Facts About FUSETRON Dual-Element Fuses

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprinsingly low.

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

Fusetron DUAL-ELEMENT Fuses

with their

10 Point Protection

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

Stop Wasting Time and Money-

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

FUSETRON Dual-Element Fuses Give ALL-PURPOSE PROTECTION

One needless shutdown — or one lost motor — or one destroyed switch or panel — may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Don't risk such losses — protect yourself by installing a FUSETRON dual-element fuse in every set of fuse clips throughout the entire electrical system.

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

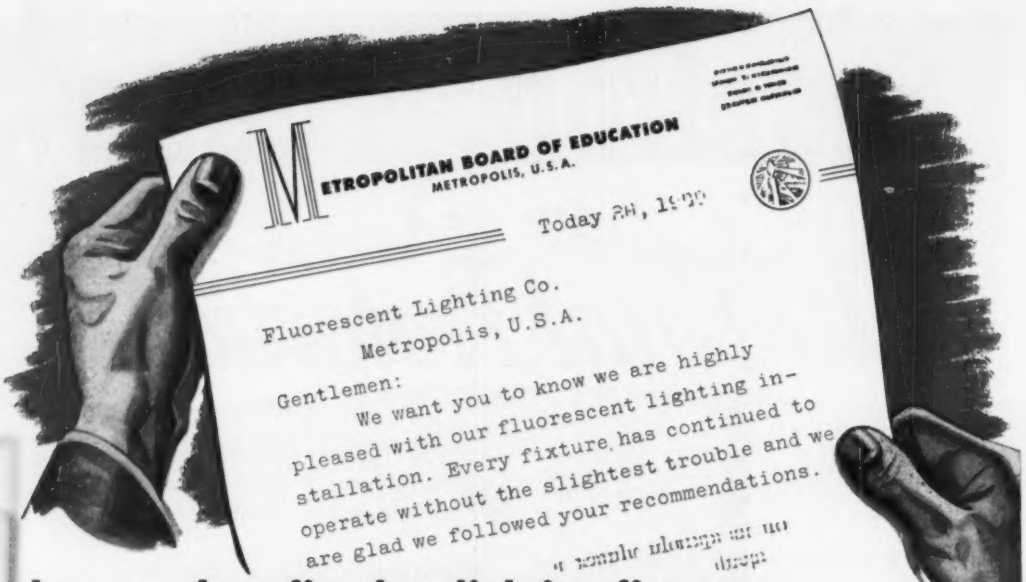
*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City & Zone*_____ *State*_____ EC & M2-50


METROPOLITAN BOARD OF EDUCATION
METROPOLIS, U.S.A.
Today
Fluorescent Lighting Co.
Metropolis, U.S.A.
Gentlemen:
We want you to know we are highly pleased with our fluorescent lighting installation. Every fixture has continued to operate without the slightest trouble and we are glad we followed your recommendations.

how you benefit when lighting fixtures are equipped with....

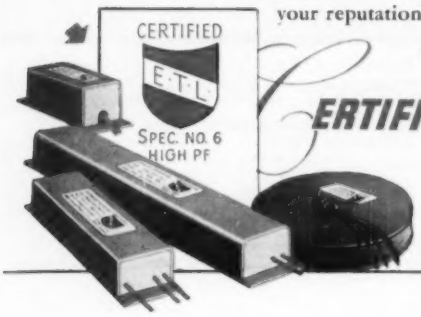
CERTIFIED BALLASTS

• Your reputation in the lighting field depends on just one thing : : : Customer Satisfaction!

That likely is a reason why more and more CERTIFIED BALLASTS are being used . . . for ballasts are a highly important factor in the performance of fluorescent lighting fixtures. And men who value their business reputation have learned to rely on the satisfactory performance of CERTIFIED BALLASTS.

CERTIFIED BALLASTS are made to exacting specifications that assure dependable, trouble-free operation of both the ballasts and the lamps. Electrical Testing Laboratories, Inc., tests, checks and then certifies them.

For fixture performance that assures customer satisfaction . . . and protects your reputation . . . ballasts that bear the "Certified" shield are your safest choice.



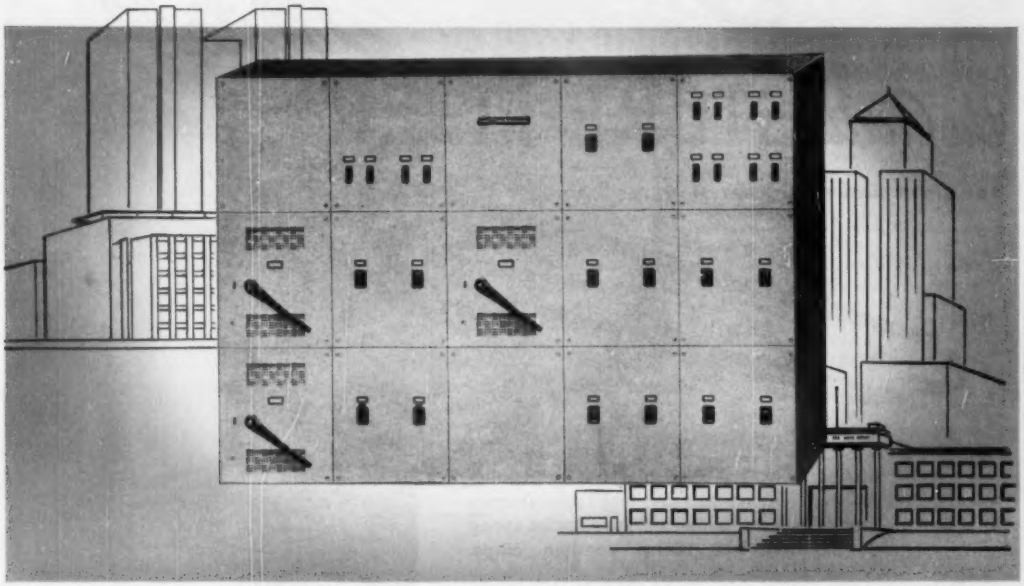
CERTIFIED BALLAST MANUFACTURERS

Makers of Certified Ballasts for Fluorescent Lighting

2116 KEITH BLDG., CLEVELAND 15, OHIO

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



New *STANDARDIZED* Building-type Switchboards

Cut Planning Time

Switchboard planning for offices and other commercial-type buildings is greatly simplified with the NEW Westinghouse *Standardized* Building-type Switchboard.

Unitized construction eliminates special design problems . . . yet their complete flexibility gives you all the advantages of "custom built" units.

Factory-assembled, wired and tested, they may be shipped as a single unit and quickly placed in service. However, if desired, they can be shipped as individual units and quickly reassembled on the job.

They are specifically designed to feature low-cost circuit breaker protection by means of Westinghouse nofuze "De-ion" type AB circuit breakers for ratings through 600 amperes. For ratings above 600 amps, Westinghouse type DA breakers are used. Get the complete story. Call your nearest Westinghouse office or write for D. B. 30-990, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40380

Westinghouse

SWITCHBOARDS

. . . its easier to *Sell*

. . . its easier to *Install*

the Curtis STORE-LITER

FOR EIGHT AND FOUR FOOT SLIMLINE LAMPS

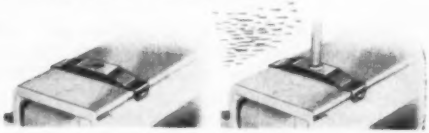
The Curtis "Store-Liter" enables you to offer the retail merchant a lighting unit which costs him less for installation . . . less for maintenance . . . and less for operation. It is designed to utilize, with highest efficiency, the many advantages of the new T-12, 96-inch slimline lamps.

High Transmission plastic side panels provide high levels of quality illumination on merchandise whether displayed on vertical racks or in horizontal cases. Selling qualities are easily seen . . . selection of merchandise is made easy for the customer.

Functional open design of this new luminaire provides for ease of maintenance. Relamping is accomplished without disturbing side panels. For thorough cleaning, side panels are easily disengaged in same manner as the lamps (push-pull principle). On your next retail store lighting job, recommend and install the Curtis "Store-Liter"...a profitable luminaire for you and your customer.

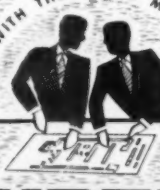
The new sliding clamp hanger makes installation of "Store-Liter" luminaire an economical pleasure.

Sliding clamp hangers are first secured to ceiling at desired locations. Completely assembled luminaires are then raised and fastened into clamps by tightening a single screw. Sliding clamp hanger also permits by-passing building construction obstacles, such as beams, sprinkler heads, etc.



WITH THE CURTIS MAN

Plan Lighting



CURTIS

Full technical details and specifications on the STORE-LITER are illustrated and described in Bulletin Four. Write today for your copy to supplement your Curtis Catalog.

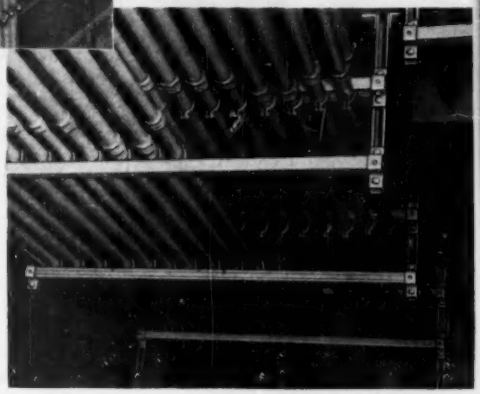
LIGHTING, INC., 6135 W. 65TH ST., CHICAGO 38, ILLINOIS

PACIFIC GAS & ELECTRIC CO.

SELECTS VERSATILE UNISTRUT TO SUPPORT CONDUIT RUNS

Heavy rows of conduit are quickly installed and easily supported with completely adjustable Unistrut channel, fittings and clamps. Note examples of combination racking where conduit is clamped above and below to channels mounted back to back.

Completely adjustable Unistrut simplifies the most difficult problems of supporting complex conduit runs used in distribution systems—permits fast, on-the-job framing assembly where all adjustments are made by just loosening a bolt, and where supporting members are added as work progresses. No drilling, no welding, no special tools or equipment. Saves time—cuts costs. Try Unistrut on your next job to see how much quicker, better and more economically the work can be done.



UNISTRUT—is metal channel with a continuous slot. You simply insert the Unistrut spring nut into the channel at approximate point where attachment of another framing member is desired, slide to exact location and bolt to Unistrut fitting. Nut is thus secured firmly to "double track" formed by inturned edges of channel to provide positive clamping action, prevent slippage.

Unistrut includes concrete inserts, pipe, tubing and cable clamps, roller pipe supports, brackets, and many other standard parts which in combination provide the world's most flexible system of support or suspension. With Unistrut you can build all types of framing, mounts, shelving, racks, tables and benches, cable, conduit and pipe hangers, fluorescent fixture supports and many other structures with only a hacksaw and a wrench. Unistrut does the complete job, you need no other parts or materials.

Write today for Free Sample of Unistrut and these Catalogs:

Catalog 500: Construction uses of Unistrut—supports, frames, mounts, etc.

Catalog 600: Materials Handling uses of Unistrut—racks, bins, etc.

THE 3 QUICK UNISTRUT STEPS

1. Insert Nut into Channel

2. Locate Fitting and Nut

3. Tighten Bolt —it's done

U. S. Patent Numbers
2327587 2380379
2363382 2345650
2329815 2405631
Other patents pending

Prompt Delivery from Warehouse Stocks in Principal Cities, Consult your Telephone Directories

The World's Most Flexible All-Purpose Metal Framing

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1013 W. Washington Blvd. • Chicago 7, Illinois

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Please send free sample of Unistrut and catalogs checked below without obligation.

Catalog 500 ☐ Catalog 600 ☐ Unistrut sample ☐

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

GREATER PROTECTION

Against most-frequent overloads

Economy "Time-Delay" Renewal Links allow maximum blowing time on starting and overloads within the 135% to 200% range where most overloads occur, thus preventing unnecessary blows and costly stoppages.

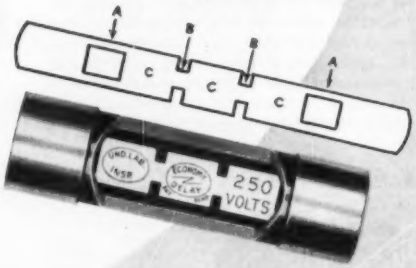
How "TIME-DELAY" Links Operate

Areas A and B are calibrated to control flow of current, so as to meet the maximum of all requirements of the "Standard for Fuses".

Area A consists of sections or bridges which control flow of current to sections C, which absorb heat and result in time delay.

Area C consists of heavy cross section zinc to absorb excess current, allowing maximum blowing time on starting loads and overloads.

See your Electrical Wholesaler.

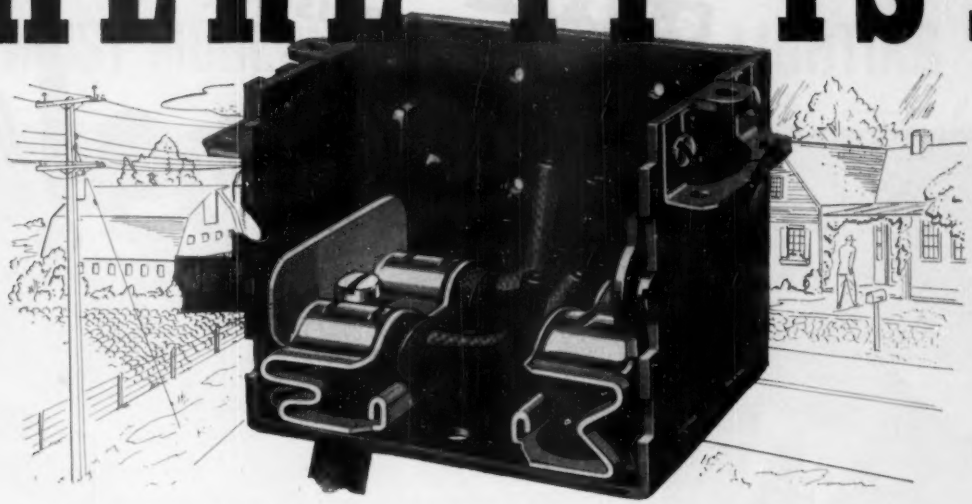


ECONOMY DE-LAY RENEWABLE CARTRIDGE FUSES

SEND FOR NEW CATALOG

ECONOMY FUSE AND MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILLINOIS REPRESENTATIVES IN ALL PRINCIPAL CITIES

HERE IT IS!



Switchbox with new "NM" clamp *

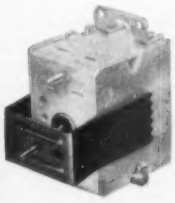
THE *RACO*—"NM" CLAMP...

Here's the perfect non-metallic-cable-clamp. The "NM" permits the cable to enter at the side (end) or bottom, or both, simultaneously. Especially designed construction protects the cable from possible injury. The clamp is held clear of the knockout until you're ready to use it. Pressure points in the "NM" securely holds conductors, far surpassing the most rigid tests. It accommodates a wide range of cable sizes and is available in both switch and outlet boxes.

Recent increased use of non-metallic cable and heavier conductors requires a clamp that can take it—and hold it! The "NM" bears the famed "RACO flag" trademark. This emblem has become a stamp of approval with contractors and wholesalers alike, who know—"You Can Always Rely on RACO".

Other *RACO*—Products

SWITCH BOX SUPPORT



Easily installed on any switch box. Can be used with all types of wallboard, providing a strong, firm mounting. Switches and particularly receptacles will stay put! No loose parts to get lost within walls.

EXPOSED WORK COVERS

Full ½" depth. For despard and similar devices. Individual containers, plainly marked. Use of the RACO Co-33 in conjunction with the RACO COD boxes has become popular for neat six-gang installations.

*Reg. Trade Mark

WRITE: ALL-STEEL EQUIPMENT INC., AURORA, ILLINOIS

RACO

ALL-STEEL EQUIPMENT INC.

600 Kensington Avenue, Aurora, Illinois

"A BOX FOR EVERY NEED"

USERS SAY G.E.'S 9574 ALL-PURPOSE* INSULATING VARNISH "is tops!"

J. L. Hughes

How do users like General Electric's new all-purpose insulating varnish G-E 9574?

Here's a statement from J. L. Hughes, owner of the J. L. Hughes Electric Company, Columbus, Ohio.

> *"We have found from test and practical experience that General Electric general-purpose varnish 9574 is tops for our work."*

Mr. Hughes knows what he is talking about. He has been in the business of motor repair and rewinding in Columbus for thirty-three years.

YES, G-E 9574 OFFERS YOU

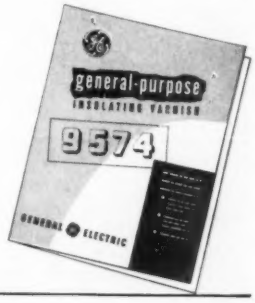
One varnish you can depend on for ALL* jobs.

A Combination of electrical, chemical and mechanical properties formerly found only in special-purpose varnishes.

Easier Handling: Low baking temperature; deep penetration; simple thinning with petroleum spirits.

**G-E 9574 gives excellent results on all types of coils except extra-high-speed armatures. It is one of G. E.'s complete line of electrical insulating materials, including adhesives, wedges, cements, compounds, cords and twines, sleeving, wire enamels, mica, papers and fibers, permafils, tapes, tubing, varnished cloths, and varnishes.*

SEND FOR BULLETIN! If you haven't yet tried G-E 9574, get in touch with your local G-E Distributor, or write for our new bulletin to Section K1, Chemical Department, General Electric Company, Pittsfield, Massachusetts.



You can put your confidence in

GENERAL ELECTRIC

CI150-K1

A New Advancement in the

MOST MODERN WAY of FACTORY LIGHTING

more LIGHT with greater *Brightness Control!*

A New Aid to Better Work, Fewer Accidents, Happier Employees, Through Better Seeing Conditions

Comfortable Seeing Conditions require that adequate Brightness Control must accompany the higher levels of illumination now being demanded by industry. Latest development in the solution of this problem is Longitudinal Shielding which is a feature now available in the Benjamin Twin Lamp Lite-Line System.

Placed between the lamps, this shield provides an additional 14 degree zone of shielding at the workers' eye levels. It minimizes glare without materially affecting the effective illumination on vertical and horizontal working areas.

There are many other refinements in "Lite-Line 40" design and construction which safeguard against energy wasting glare. Among them are the light diffusing Porcelain Enamel reflecting surfaces and the design of the reflector contour. These help make possible the attainment and maintenance of higher levels of illumination with greater seeing comfort.

BENJAMIN TRADE MARK

"Lite-Line 40" RLM

SYSTEM OF FLUORESCENT LIGHTING

DISTRIBUTED EXCLUSIVELY BY ELECTRICAL WHOLESALERS

E-3039

FREE DATA BULLETIN

BENJAMIN ELECTRIC MFG. CO., Dept. H, Des Plaines, Illinois

Without cost or obligation, please send Lite-Line Data Bulletin "LS"

Name_____ Title_____

Firm_____

Address_____

City_____ State_____

Central National Bank, Chicago, Illinois
Architects: Graham, Anderson, Probst, White
Fixture Manufacturer: Morris Kurtzon, Inc.
Electrical Contractor: Hultgren Electric Co.
Glass: CORNING ALBA-LITE

Your most adaptable fluorescent lighting medium . . .

Corning "ALBA-LITE"

ALBA-LITE "55"

ALBA-LITE "66"

ALBA-LITE "77"

ALBA-LITE "88"

This photograph gives you an idea of how well CORNING ALBA-LITE diffuses fluorescent light . . . especially desirable for office work. The qualities of diffusion and brightness control are contained within a thin opal glass panel. This makes ALBA-LITE adaptable to almost any type of installation whether recessed or exposed.

There is no limit to the design flexibility that can be achieved with ALBA-LITE. It is obtainable flat or bent in four standard patterns as shown.

Widths vary from 2″ to 24″, lengths from 8″ to 100″. It may be used in fixtures, or glass ceilings, as required.

Corning lightingware is sold through all leading fixture manufacturers, many of whom feature ALBA-LITE fixtures. Bulletin LS-17 describes this versatile lighting glassware in detail and illustrates many ways it is being used. This new 30 page bulletin is yours for the asking.

CORNING GLASS WORKS **CORNING, N. Y.**

Corning means research in Glass

FOR EFFICIENT, ATTRACTIVE LIGHTING...

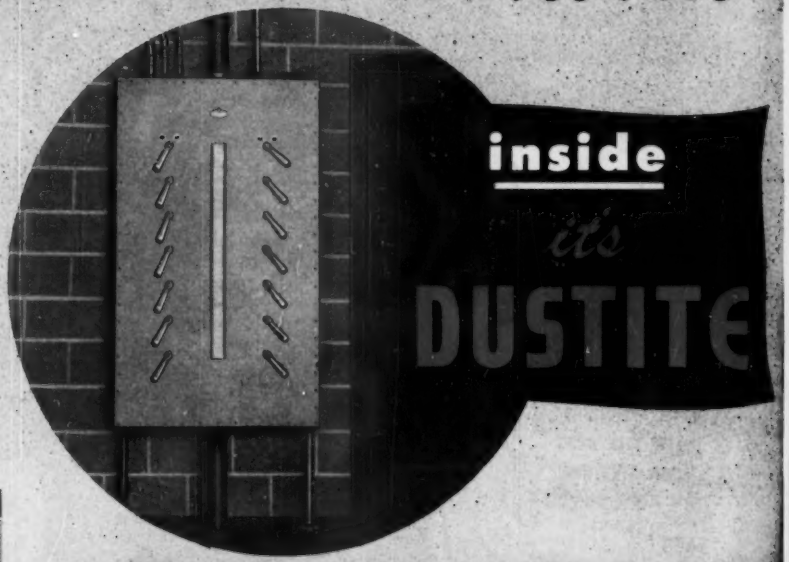
CORNING ALBA-LITE for diffusion of fluorescent light

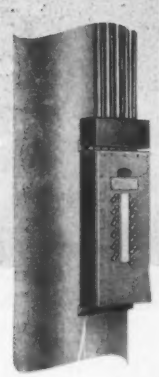
CORNING FOTA-LITE for high level illumination

PYREX brand LENSLITES and CORNING brand LENS PANELS for prismatic light control

Technical Products Division: **Lightingware, Laboratory Glassware, Plant Equipment, Glass Pipe, Signalware, Gauge Glasses, Optical Glass, Glass Components**

No hazard here . . . *because*





Typical lighting panelboard illustrated above; typical power panelboard in circle.

Designed for use where carbon black, coal or coke dust, grain dust and other dust conditions are hazards.

Approved by Underwriters' Laboratories, Inc., for Class II, Groups E, F & G Hazardous Locations.

FOR THOSE COMPANIES plagued with the hazards of volatile dust, the Frank Adam Electric Company has designed special light and power panelboards that provide *dust-free* performance, safety and dependability . . . regardless of the external dust condition . . . because ● DUSTITE PANELBOARDS remain dust-free *inside*.

These ● DUSTITE PANELBOARDS seal out the hazards of dust by means of dust-tight welded hubs for conduit outlets . . . welded box corners . . . external mounting brackets welded to back of cabinet . . . and a solid steel front plate with gasket protection all around.

The circuits are externally operated by a dust-tight mechanism of ● design. The handles operate through dust-tight bushings and engage the regular handles on the circuit breakers *inside* the cabinet. ON and OFF positions are indicated on the front of the cabinet.

And there's no reason to get inside the cabinet because all ● DUSTITE PANELBOARDS are of the automatic circuit breaker type, which provide protection without need for replacement of any parts.

Capacities 15 to 600 amps., 250 volts AC or DC, and 600 volts AC, main lugs only, or main circuit breakers.

Avoid the hazards of dust in your light and power panelboards by making them ● DUSTITE.

Inquiries solicited . . . just address your nearest Ⓕ Representative (he's listed in Sweet's) or write for Bulletin 302.

FA TRADE MARK

Frank Adam Electric Co.

ST. LOUIS 13, MISSOURI

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

"BEST LIGHTING INSTALLATION I EVER MADE!"

"THEN WHY NOT EQUIP IT WITH THE BEST TIME SWITCH YOU CAN BUY?"

Finish the Job Right!

INSTALL A SANGAMO TIME SWITCH

★ The time switch is a small investment compared to the total cost of your lighting installation, but it is a highly important factor in its successful operation. When you choose a Sangamo Time Switch you finish the job *right* by assuring perfect automatic control. You protect yourself against annoying service calls due to faulty time switch operation . . . you save on man hours, too . . . and you safeguard the prestige of your installation.

There's a time switch to meet your exact needs in Sangamo's complete line of *high-quality* time switches. The Type L, for example, is a heavy-duty versatile unit for continuous service under widely varying conditions. It can be supplied with a number of control features such as an omitting device, advanced time cut-off, or an astronomic dial for automatic sunset to sunrise operation. All these features are also available on the Type W, which is a switch that does not have to be reset after current interruptions. The Types L, W, and all other high quality switches of the complete Sangamo line are stocked by your electrical wholesaler.

Write for Sangamo's new 16 page Time Switch Catalog No. 1010A. It tells everything you should know to help you choose the best possible time switch for your next installation.

SANGAMO

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Have You Tried the SANGAMO TYPE S?

Here's precision in miniature! An economical, compact, unusually attractive time switch for simple time control problems.

ETMP-8

No Solder...Tape or Tools!

....FOR FASTER, BETTER WIRE JOINTS

you can't beat IDEAL wiring tools to speed wiring jobs

Coil-Flex Fish Tape
(PAT. PENDING)

Speeds wire pulling in all kinds of conduit. Steel spring wound around rust-proof cable slips easily around 90° bends. Never kinks, snarls or springs loose. 25-ft. lengths quickly join into longer tape.

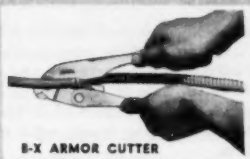
QUICKEST, EASIEST WIRE STRIPPING!

Stripmaster
(REG. U. S. PAT. OFF.)

Hand-Type Wire Stripper

Only stripper of its kind. Single light squeeze strips wire up to full 7/8 in. "Automatic" feature positively prevents crushing of wire. Just insert wire, squeeze and release. Four models — for all wire gauges from 8 to 22.

EASIEST WAY TO CUT B-X



B-X ARMOR CUTTER

Just place cable in jaws, squeeze handles—then twist cable and pull apart. No hacked or torn fingers, no damaged insulation. Cuts anywhere along length of cable. For all B-X cable, No. 10, 12 or 14 (two or three wire).

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THE SOLDERLESS, TAPELESS, WIRE CONNECTORS
Patented — No. 1,933,555

THE CONTRACTOR'S STANDARD FOR OVER 26 YEARS—

There *is no other way* to make dependable wire joints — as economically as with IDEAL "Wire-Nuts". Just strip wires and screw on "Wire-Nuts" — that's all. Makes wire joints twice as easy — ten times faster! — when running circuits, hanging fixtures, etc. Safe for a lifetime . . . precision-built "Wire-Nuts" can't pull or shake loose. Bakelite lifetime shell keeps sharp wire ends covered. . . . IDEAL "Wire-Nuts" are the world's strongest, safest, best-made wire connector. Their proved dependability cuts your costs — gives you a perfect joint every time — *the first time!*

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SEND FREE SAMPLE IDEAL "WIRE-NUTS" — SEND CATALOG DATA ON WIRING TOOLS

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NOW! NEWEST ADDITION TO THE TOMIC FAMILY OF FITTINGS!

No. 12 TOMIC 1" THINWALL CONNECTOR

No. 312 TOMIC 1" THINWALL COUPLING

to meet the demand of the industry!

No. 12 TOMIC 1" THINWALL CONNECTOR

Interior stainless steel lock washer holds tubing securely . . . makes uniform, safe, permanent, vibration-proof 6-point ground around entire tube. OK in concrete slabs. No inside ridges to snag fishtape or fray wire. Easy to install—easy to inspect. Ideal for cramped or corner locations. Simple, strong, solid construction—cadmium finish.

No. 312 TOMIC 1" THINWALL COUPLING

Screws in on straightaway jobs . . . snaps in on corner jobs. No tools needed. Can not shake loose. Positive ground. Smooth raceway assured. Easy to install—easy to inspect. Simple, strong, unique construction makes possible a versatility unsurpassed by any other coupling.

Watch TOMIC Grow!

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- No. 200 Service and Range — ¾" K.O.
- No. 3338X and ½" Greenfield.
- No. 10 — ½" Thinwall Connector
- No. 11 — ¾" Thinwall Connector
- No. 12 — 1" Thinwall Connector
- No. 310 — ½" Thinwall Coupling
- No. 311 — ¾" Thinwall Coupling
- No. 312 — 1" Thinwall Coupling
- No. 90 — Box or Fixture Hanger
- No. 91 — Centering Clamp for above

THE MOST VERSATILE COUPLING EVER CONCEIVED!

- Change from heavy pipe to Thinwall and vice versa in the middle of a job.
- Can be used to go from Thinwall to Greenfield.
- Can be used to go from Thinwall to BX, Romex, rubber cords or welding cable, etc.
- No expensive, special fittings required.

Insist on Tomic...and Save!

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1950 . . .
Our Industrial Machine Is Running Down

In his recent Economic Report to Congress President Truman chalked up a constructive advance in his economic reasoning. He pointed out that if we are going to attain the worth-while goal of a $300 billion national income in the next five years, we must equip ourselves with more and better industrial tools. Of all the dynamic forces of expansion in America, he said, one of the most important is business investment.

That is fine. It is basic common sense. We have been saying that for years and we are glad to hear the President say it too.

But having hit this new high in his economic reasoning, the President failed to draw the right conclusion. He made the mistake of accepting the false conclusion that there is no shortage of business funds to pay for more and better industrial tools. "There are immense opportunities for business investment in nearly every segment of the economy," the President said, and further, "there are in general sufficient funds available to businessmen who want to seize these opportunities."

That just is not so — and the lack is not only serious; it can well be fatal.

It is a matter of the most urgent national importance that the President's recognition of the need of more and better industrial tools should be followed by effective action. *That calls for changes in the national policies that are now blocking and, unless changed, will increasingly block business from meeting this need. If business cannot get enough new tools, the result will not be higher, but lower standards of living five years from now.*

The President should talk this matter of business investment over with Senator O'Mahoney, the Chairman of the Joint Congressional Committee on the Economic Report. Senator O'Mahoney would take to the discussion knowledge of the investment situation recently acquired through his conduct of a series of Congressional hearings.

If he told the President what he told the press during the course of these hearings, he would say, "the private capitalistic system is being seriously threatened by a lack of venture capital." That is in direct conflict with the President's conclusion that "there are in general sufficient funds available."

This serious shortage of adequate investment in new plant and equipment is brought forth so that all of us can understand it by McGraw-Hill's annual survey of American industry's plans for investment in new plant and equipment in 1950, which has just been completed.

continued on next page

BUSINESS' PLANS FOR 1950

These are the major findings of the McGraw-Hill survey of "Business' Plans for New Plants and Equipment" in 1950. Made by the McGraw-Hill Department of Economics, the survey shows:

1. Industry—as represented by manufacturing, mining, transportation, and utilities—now plans to invest $12.4 billion in new plants and equipment this year. This is 13% less than was actually spent last year.

2. Manufacturing industries alone plan to spend $6.3 billion in 1950 for new facilities. This is also 13% less than they spent last year.

3. Manufacturers as a whole expect their 1950 sales volume to about equal 1949's.

4. Manufacturers will expand their capacity about 3% in 1950, under present plans. The largest part of their funds, 65%, will go to replace and modernize existing facilities.

5. Profits and reserves are expected to provide 92% of the 1950 investment funds of manufacturing companies. These companies count on new common stock issues to provide less than one-half of one per cent of the investment funds they will need.

6. Two out of three manufacturing companies review their investment plans monthly. Almost all companies go over them at least quarterly. The survey shows that companies changed plans rapidly during 1949 to meet changes in their prospects.

7. Other industries are also reducing their investment plans in 1950 by 13%. This coincidence arises from the fact that utility companies, notably the electric light and power companies, plan to spend only slightly less than in 1949. Railroads, on the other hand, are reducing their capital programs in 1950 by more than 40%.

A copy of a complete report on "Business' Plans for New Plants and Equipment" may be obtained by writing me at McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 18, N. Y.

The results of the survey, which are summarized above, show that American Industry—as represented by manufacturing, mining, transportation and utilities—is planning to spend 13 per cent less for new plant and equipment in 1950 than it did in 1949.

Since the rate of investment in new plant and equipment right now is apparently about 15 per cent below the rate for 1949, the present level of business investment may be relatively steady in 1950. That would relieve the fear, expressed by President Truman in his Economic Report, that "if the downward trend in business investment were to continue, our prospects for full recovery and continued expansion would be seriously endangered."

BUT, at the rate of investment planned by American manufacturing industry for 1950, it would take 40 years to modernize thoroughly our present industrial plant and equipment. That would still leave undone the job of increasing it to meet the needs of an expanding economy of the kind sketched by President Truman in his message.

In attaining even this rate of investment, the McGraw-Hill survey shows American business must rely overwhelmingly on its own profits, which have declined as the country has left the postwar boom behind it. Most American companies cannot sell new common stock except at ruinously low prices. Here is one case where government action is really needed to help business and help to keep a rising American standard of living.

In order to get enough business investment to assure the "full recovery and continued expansion" sought by the President, our country needs:

1. Lower taxes on business income so as to release more money for new plant and equipment.

2. Liberalized depreciation allowances on old plant and tools so that business can buy new equipment faster.

3. Repeal of the present double taxation of dividends which now are taxed once as corporation income and again as personal income.

It is encouraging to have the President explicitly recognize the key importance of adequate business investment in providing steadily expanding prosperity. The next and most important thing to do is to make this recognition effective by discarding national policies which are blighting an adequate volume of business investment.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

PLEXIGLAS *diffusing panels in control room of Philadelphia Electric Company generating station. Large sections of white translucent* PLEXIGLAS, *installed below cold cathode tubes, give excellent glare-free illumination.*

A Lighting Fixture as Big as the Room

IT'S PLEXIGLAS

Here's the newest thing in large-area lighting—*pure illumination without glare or shadows*—diffused by large PLEXIGLAS plastic panels, installed wall-to-wall. And here's safety overhead, because PLEXIGLAS is light, strong, shatter-resistant.

Actually, white translucent PLEXIGLAS diffuses light so completely that shadows and glare simply vanish. Minimum absorption and maximum transmission of light give full, even illumination throughout any room. Brightness ratios are remarkably low.

PLEXIGLAS ¼″ thick has seven times the impact strength of glass—yet weighs less than half as much. Light weight and shatter resistance permit its use in large sections with complete safety and ease, and economy of installation. Maintenance costs are negligible.

You'll find PLEXIGLAS wall-to-wall diffusing panels in banks, drafting rooms, stores, classrooms and control rooms—wherever *glare-free* lighting is desired, and safety with savings is essential. Tell us about *your* lighting problem. We'll be glad to send you full information regarding *modern* lighting with PLEXIGLAS.

PLEXIGLAS *is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.*

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Apply the SURE CURE for Fading Lights!

Lights go dim? Blink?

When you aren't getting the light you require, in spite of a well-planned lighting system, it's often a sign of undervoltage, the inevitable result of growing or changing loads that tax existing circuits. Correct this quickly, economically.

APPLY THE *SURE CURE:* Bring high-voltage power close to load centers with Westinghouse Dry-Type Transformers.

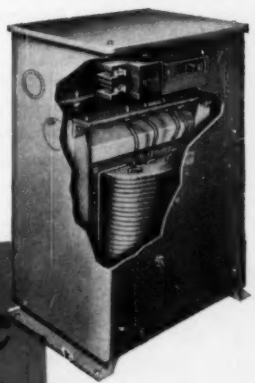
Overextended or overloaded lines cause voltage to drop. A loss of only 10 volts in a 120-volt circuit cuts incandescent light output 25%, makes fluorescents dim and often unstable. Motors, heating equipment and other electrical apparatus lose proportionately. But taking high-voltage power close to secondary loads reduces voltage drop and minimizes power losses.

Because Westinghouse Dry-Type Transformers are smaller and lighter, they can be installed easily. There is no need for fireproof vaults—mount them overhead, on shelves, posts or platforms. Welded sheet steel cases completely enclose the transformer for safety and a trim appearance.

You can be sure of effective correction of overloaded circuits with Westinghouse Dry-Type Transformers. For complete information, write for Booklet B-4009. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-70534

NOW AVAILABLE WITH BUILT-IN CIRCUIT BREAKER

New Types AJRB and AVRB give you a transformer and circuit breaker in a single, compact package. The need for separate protective devices is eliminated.



WESTINGHOUSE

Westinghouse

DRY TYPE TRANSFORMERS

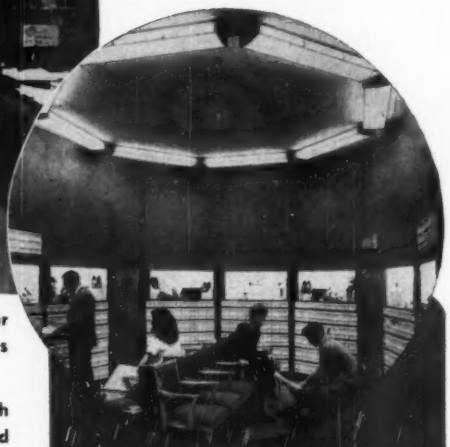
Doing A Store Up *Bright*

With Wakefield Grenadiers and Spots

The Store: ESSERMAN'S Specialty Shop, Rome, Ga.

The Architects: POUNDSTONE, AYERS & GODWIN, Atlanta, Ga.

The Lighting Engineers: GEORGIA POWER COMPANY



When an extensive remodeling job was planned for this popular 53-year old Georgia store, the architects and the lighting engineers chose Wakefield Grenadier fluorescent Luminaires and Spots.

Result: a comfortable yet stimulating shopping environment with general illumination of about 50 footcandles; and with glare and brightness contrasts at a minimum despite lavish use of strategic spotlighting.

A shielded, louvered fluorescent luminaire with metal-framed plastic side panels, the Grenadier provides a highly efficient type of diffused light. It is designed to take 40 W or Slimline lamps, and is also available equipped with a single or double spotlight assembly permitting a 35° adjustment in any direction.

THE F. W. WAKEFIELD BRASS COMPANY • VERMILION, OHIO

All Three { *ARCHITECTS ENGINEERS CONTRACTORS*

favor Wakefield Grenadiers for Store Lighting because

1. efficient type of diffused lighting
2. combination of general and spot lighting in one fixture
3. easy, quick installing; one man can do it
4. easily maintained; can be re-lamped through side or bottom and top when suspended
5. certified ballasts
6. Underwriters approved
7. fully guaranteed

Wakefield

Over-ALL Lighting

FOR SCHOOLS • OFFICES • STORES

What is the Difference?
These boxes are of different makes, yet they are as much alike as two peas in a pod. It is doubtful if an experienced electrical craftsman or even the makers of the boxes could identify them.
So it is with certain other common types of electrical boxes and conduit fittings.
But a BIG difference will be found when entire LINES of boxes and fittings are compared.
It will be found that Steel City's line is not limited to easy to make items, items in greatest demand, or which show a better profit. It is a COMPLETE line of boxes and fittings, constantly kept up to date with wiring requirements.
In switch boxes, outlet boxes and covers and conduit fittings . . .
Steel City Leads
In Meeting Contractors' Needs
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A B C ARMORED CABLE

Has These Improved Features Which Make Installation *EASIER—QUICKER—SAFER*

Bond Strip Under Armor

Permanently low armor resistance **is provided in sizes No. 14 and 12 AWG by use of a flattened, bonding wire which is in contact with the under side of each convolution.**

Prefabricated Break Lines

The Cut Mark (at 1½" intervals) shows the location of a prefabricated breaking line inside the armor. Only a few strokes of a file or saw guided by the Cut Mark are required to cut through one outer ridge, and a bend by hand severs the armor. This results in a clean separation with no sharp edge—a safer, easier and faster job. The prefabricated breaking lines are so designed that there is *no reduction* in tensile strength, bending quality, crushing resistance and electrical conductivity of armor.

FILE OR SAW

BREAK

PULL OUT PAPER

INSERT BUSHING

In the last 20 years alone, over SIX BILLION FEET of Armored Cable have been produced by the industry. Armored Cable provides the only general purpose, factory-assembled and tested, metal protected wiring system.

CRESCENT WIRE & CABLE

OVER 60 YEARS EXPERIENCE

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.

Eyes have it Easy AT YOUNG & RUBICAM

YES SIR! Eyes *do* have it easy in this light office of one of America's top advertising organizations. And that's important in any business where fast decisions, fast actions are required. Ample, evenly distributed light eliminates eyestrain—unleashes extra energy to speed work and lend sparkle to creative thinking.

Whenever you have a lighting problem come *first* to Litecontrol. You'll find Litecontrol fixtures unusually efficient—Litecontrol engineers expert in planning outstanding lighting installations. And they'll be glad to help you with suggestions or complete layouts.

YOUNG & RUBICAM, INC.
285 Madison Ave., N.Y.C.

Lighting Equipment: Litecontrol No. 4044 pendant mounted fixture
Spacing: 10 foot centers
Lamps per fixture: 4–40 watt
Footcandles: 35 in service (average)

WRITE TODAY! This new catalog is yours for the asking

Contains: Pictorial Index for easy, quick reference. Complete descriptions and specifications on all Litecontrol fixtures, including utilization factors, formulae and all data necessary to figure an installation from start to finish.

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Fixtures

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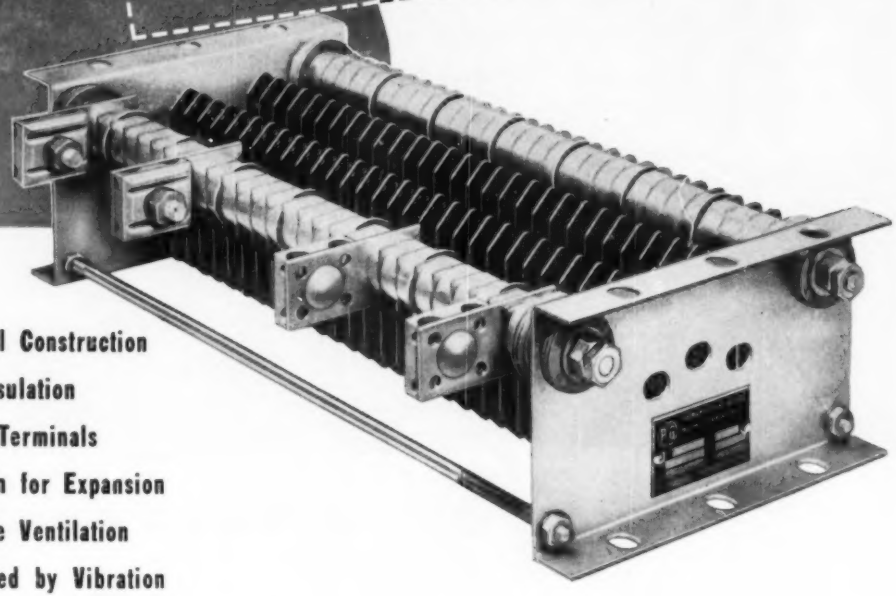
STEEL GRID
Resistors



All Steel Construction
Mica Insulation
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Provision for Expansion
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Unaffected by Vibration
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These Post-Glover Standard Resistor Units will increase production equipment availability thru reduction in motor maintenance and machine hours lost from electrical failures. P-G Steel Grid Resistors are rugged because they are built of steel and mica. Add to this, sound resistance values with ample capacities and failures due to resistor trouble cease to exist. Specify P-G for your next application, especially, if your operating conditions are severe.

P-G

The Nonbreakable Steel Grid Resistor

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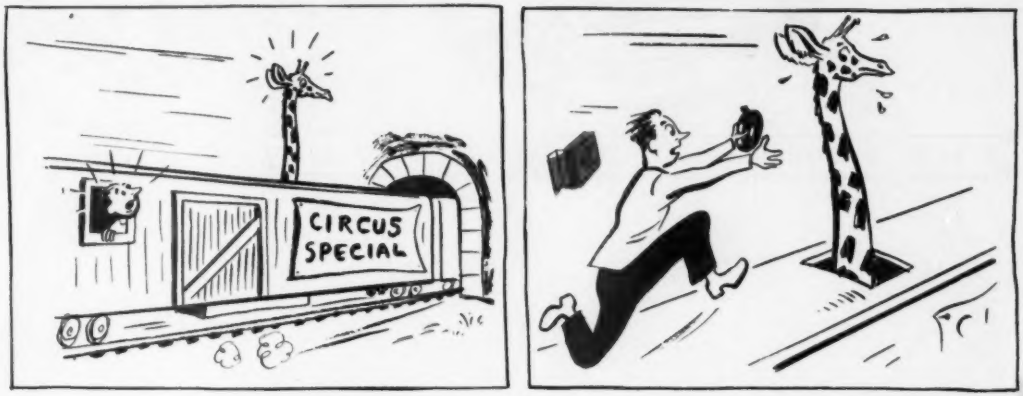
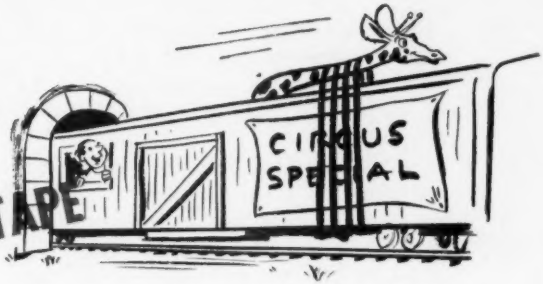
You can do a lot



with a little GOLD SEAL TAPE



Here's a tape you can count on to speed any job — and stick to the job. And a roll of Jenkins Gold Seal will always go further, because there's no waste.

What a difference it makes, working with tape that tears evenly, quickly. It will not dry out, peel or ravel, yet makes a tighter, longer-lasting bond. Production is carefully controlled to assure lasting "tack" in the friction compound.

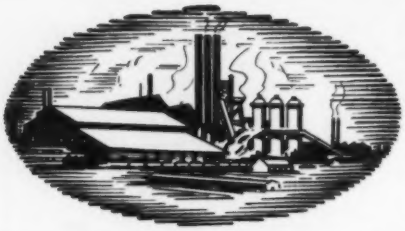
No wonder Gold Seal is the lasting favorite of linemen and electricians! There's more tape value in every roll. Buy 'em by the carton (10 rolls) or singly. Each roll individually wrapped in cellophane to keep it *factory-fresh*. Jenkins Bros., (Rubber Division), 80 White St., New York 13, N. Y.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet both ASTM and Federal Specifications.

JENKINS *Gold Seal Tape*

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES



1900 ★ THE MIRACLE OF AMERICA ★ 1950

Freedom and Progress

It's no stretch of the imagination, rather, robust realism to call our past half century a Miracle—U. S. A.

America has set an amazing record of progress in 50 years—but a moment in the history of civilization. A record unequalled by any other political or economic system.

Merely by broad brush strokes, we can all visualize this miracle. Remember the crystal set, the hand-cranked car, the biplane? A far cry from our FM radio, television, hydro-matic drive and supersonic planes.

And here's another phase of the miracle that went hand-in-hand with these and the myriad of intertwined technological advances—ranging from the radio telephone and Bakelite to the X-ray tube and teletype . . . and to atomic energy and its untold potentialities.

- Since 1900 we have increased our supply of machine power 4½ times.
- Since 1900 we have more than doubled the output each of us produces for every hour we work.
- Since 1900 we have increased our annual income from less than $2400 per household to about $4000 (in dollars of the same purchasing power), yet . . .
- Since 1900 we have cut 18 hours from our average work week—equivalent to two present average workdays.

How did we do it? The basic cause for this composite miracle has been the release of human energy through FREEDOM, COMPETITION and OPPORTUNITY. And one of the most important results is the fact that more people are able to enjoy the products of this free energy than in any other system the world has ever known.

THIS IS THE MIRACLE OF AMERICA . . . it's only beginning to unfold.

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Safest...Easiest...Coolest!

New Federal Noark Front-Operated Safety Switch

ANY WAY YOU LOOK AT IT, the new Federal Noark Front-Operated Safety Switch is absolutely your one best buy. It's the *safest* safety switch . . . the easiest switch to install and to maintain . . . the coolest in operation.

To assure cool operation, there are only two joints to each pole, and steel springs hold them under extreme tension. What's more, it has an ingenious one-piece fuse terminal and lug construction . . . a patented high pressure fuse holder.

For utmost safety, operating cross bar *beneath* blades guarantees current break . . . visible blade construction . . . 3-position handle . . . tamper-proof cover . . . instantaneous arc extinguishers.

New Federal Noark Front-Operated Safety Switches come in 30,60, and 100 amp. capacities, for 230-volt A.C.—250-volt D. C. and 575-volt A. C.—600-volt D. C. Order them from your distributor for superior service and economy right now. And ask us for detailed literature. Federal Electric Products Company, 50 Paris Street, Newark 5, New Jersey.

Federal NOARK

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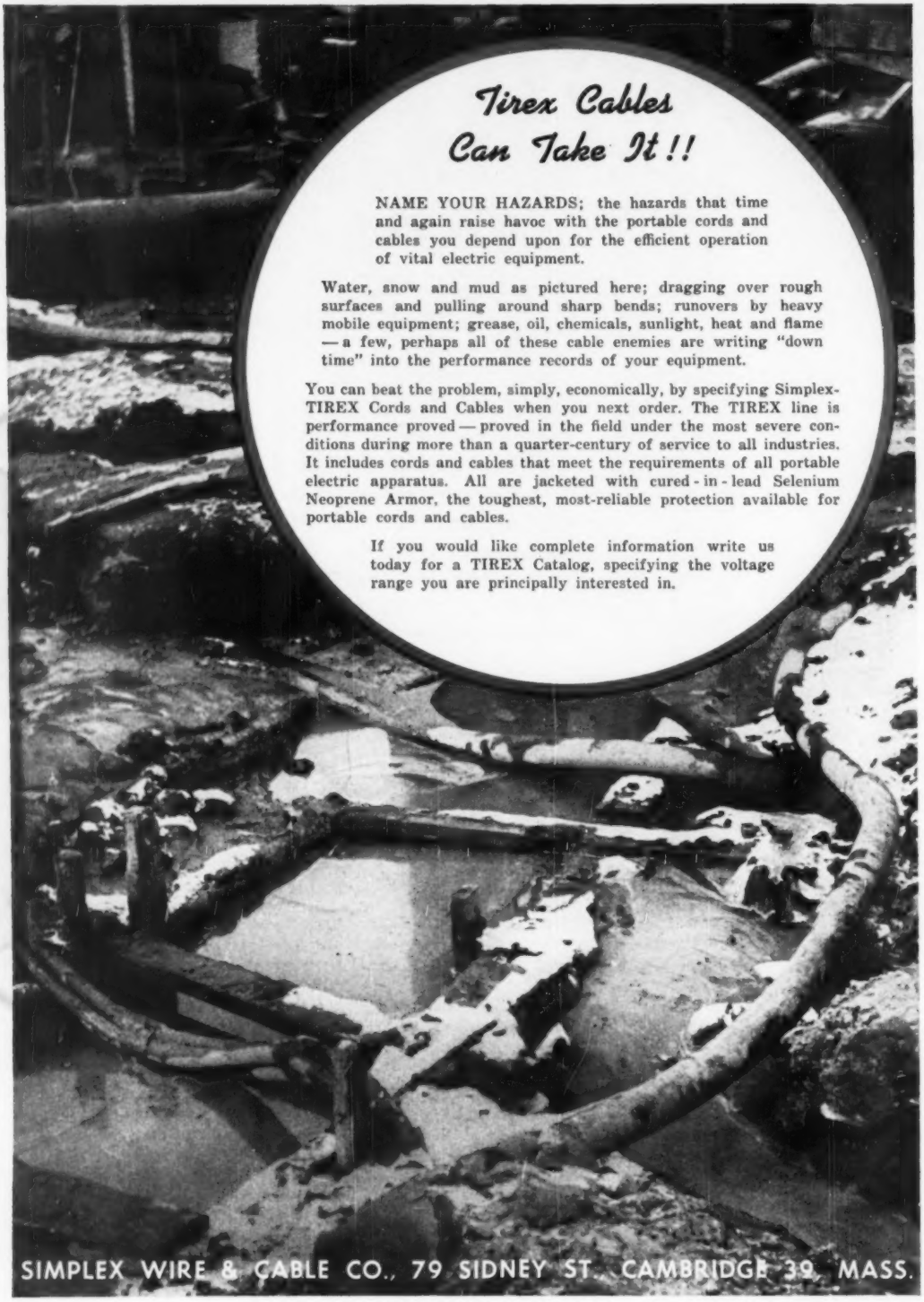
Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales Offices in principal cities.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Can Take It!!
NAME YOUR HAZARDS; the hazards that time and again raise havoc with the portable cords and cables you depend upon for the efficient operation of vital electric equipment.
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SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

FEBRUARY . . . . *at a Glance*

Modern Industrial Wiring

Not many electrical construction men are currently concerned with industrial projects of the size and scope of the new G.E. turbine plant in Schenectady. Why, then, do we spread such a story over nine pages in the feature section as we do this month?

Ordinarily, we don't give much space here to the inner works of editorial operations. But we think you will be interested in the technique of preparing an "Outstanding Electrical Construction" article and may even read them more profitably henceforth.

A project of great size and scope usually has everything; top-flight engineering, exceptional management, modern materials employed efficiently and installed with the best of workmanship. But the materials are those widely available in the industry, the skills and know-how employed are readily adaptable to a great many industrial projects.

So, in collaboration with the electrical contractors, our editors explore the plans, the work in progress, and the job office. Out of a great collection of data, drawings and photos, a very few are carefully selected. Certain aspects of the work which show the methods to best advantage are segregated. Each of these is further distilled into a separate complete article. What comes out is one brief article on the size and scope of the project and four or more distinct articles drawn from it, the whole tied together under a common tag-line.

The big job is a mine of useful information for electrical men everywhere. That's what we look for and try to bring out. The popularity of the series indicates we have done so with some success. You will find that "G.E. of Schenectady" has solid stuff in it for everyone concerned with modern industrial wiring, regardless of the scope of his current activities.

Industrial Modernization

Market projections this year point up a market area that calls for genuine development in the months ahead. Major industrial construction is sharply off from the levels of recent years. Yet proposed new plant and equipment expenditures projected by a nation wide McGraw-Hill survey show only a moderate downtrend. The logical conclusion is that there is an important shift from new bricks and mortar expansion to in-plant modernization. From the standpoint of electrical materials and labor the shift may represent an actual increase in market potentials.

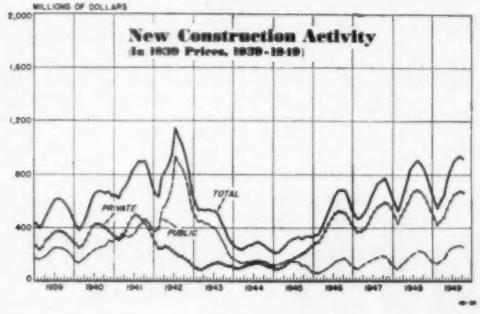
There is an important difference, however, in the accessibility of the in-plant modernization market and the means which must be employed to develop it. The new building job is accessible through conventional construction industry channels and the job is usually wrapped up in one big package. Modernization, however, often involves a long series of relatively small electrical projects following the installation or relocation of equipment. The work must usually be sought out and developed in close collaboration with plant management and personnel. Constructive counsel and intelligent planning help can assure efficient integration of the immediate electrical work into a foresighted plan with resulting economies for the customer and excellent business opportunities for the contractor.

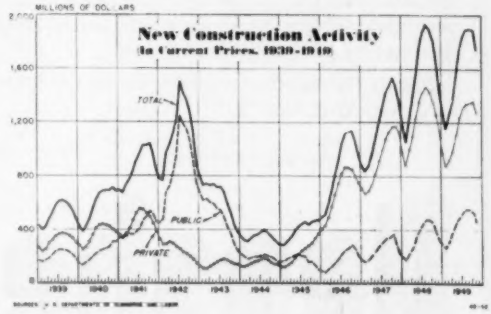
Estimating

Take-off is the first critical phase of electrical estimating method. In the second of our series on "How to Estimate Electrical Work," page 58, the basic principes and methods and the use of the rotometer and tally are discussed. Further articles will develop methods of listing and pricing with emphasis on the small and medium sized project.

Paper Work

The wide variety of work flowing through the motor shop and the importance of good detailed records of customer requirements over a period of years requires a well designed system of order and report forms. The simplified but highly effective methods employed by the Houston Armature Works in Houston, Texas, use multiple-copy order forms and a tight order number control with full data winding up in neat bound volumes for permanent reference. The story, "Simplified Motor Shop Job Control" begins on page 62.





PROTECTION

ANACONDA
from mine to consumer

DENSHEATH, the Anaconda thermoplastic Type TW building wire, gives you the maximum in *protection.*

One of Densheath's important advantages is its protection against cutting and abrasion. Pull it hard over the sharp edge of an outlet box. The chances are you won't even dent the tough insulation. More protection: Densheath will not burn . . . is long aging . . . impervious to acids, oils and alkalis . . . has low moisture absorption.

Densheath protects profits, too: time is saved on the job by its special, slick finish for easy fishing . . . light weight for light work . . . permanent, bright colors for quick circuit identification . . . small diameter for more wires in a conduit.

Specify Densheath. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

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THE DENSHEATH ADVANTAGE IN REWIRING WORK

TYPE R

3 #10 Wires permitted in ½" conduit

6 #10 Wires permitted in ½" conduit

TYPE TW (ANACONDA DENSHEATH)

National Electrical Code recognizes Densheath for circuits to 600 volts, temperatures to 140° F., and for wet and oily locations.

Densheath*

THERMOPLASTIC TYPE TW BUILDING WIRE

PROFIT PROSPECTS

BY MOST PROJECTIONS, in published statements and in the private councils of the electrical business, this year will provide record volume in materials and manhours. While first month figures are not available yet, we have run into some highly optimistic spot checks on business activity. But profit weakness persists.

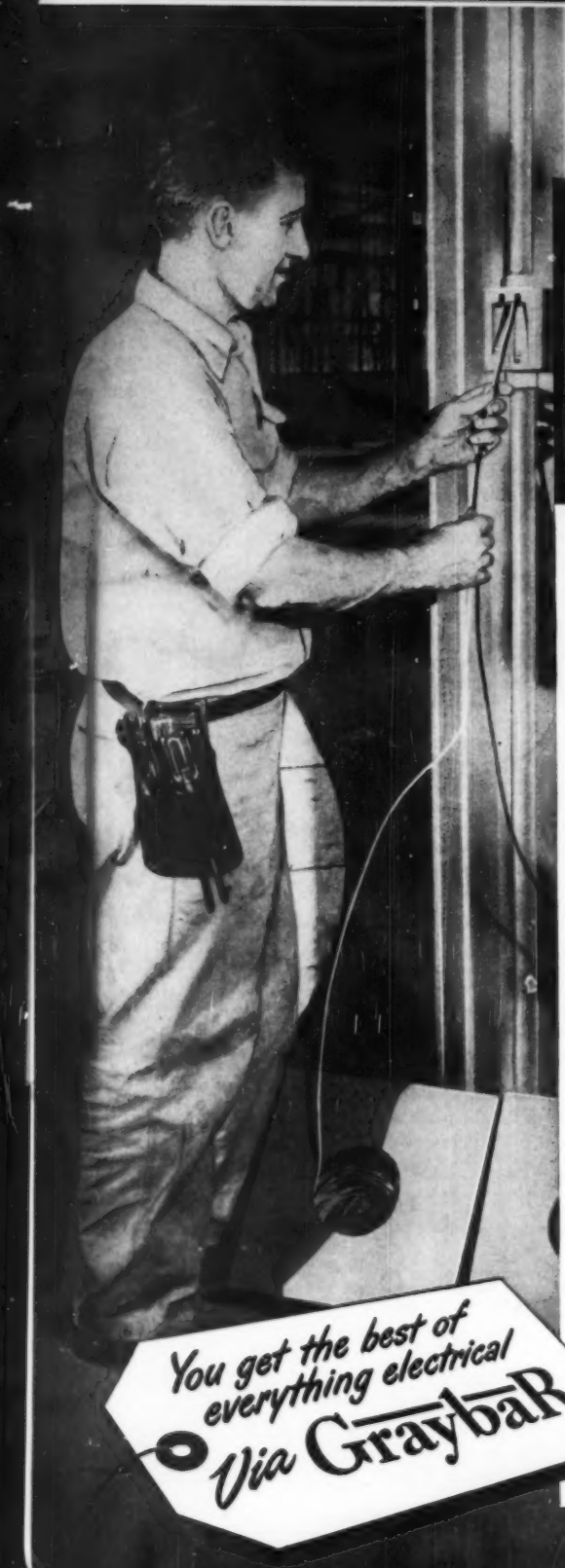
COMPETITIVE BIDDING in the presence of a sound profit pattern can be constructive. To make and maintain profit is a powerful incentive driving toward better management and better methods. Once competition forces out sound and reasonable profits at the job level, however, it becomes destructive. Possible losses must be contained and margins augmented by price shopping upstream in the trade channels.

THESE THINGS have happened before in the memory of most of us. But they happened in declining markets. They worked like a "short" sale over the relatively long span of time between a contract and the actual delivery date of the various materials and equipment. No such conditions prevail today. Prices generally are backed up against an inflexible floor of basic material costs and the solid rock of wage levels. Shrewd price buying is taking advantage of some momentary jockeying for position or volume. But those extra "fives" are coming out of already pinched margins in the presence of static or rising costs. They show no signs of a basic price movement.

A MARGIN SQUEEZE in a high volume, stable cost market has some definite limitations. Inadequate salesmanship, bad marketing judgment and volume mania eventually show up on the balance sheet. And management, however inept, on a declining net will usually seek a sound profit prospect. Fewer salesmen will be authorized or encouraged to "meet any price". Resistance to price shopping firmed notably at the turn of the year is expected to toughen even more as the construction season opens up.

ON WORK NOW TAKING BIDS the profit prospects are very likely to be limited to those anticipated in the markup. To count on any important softening of material quotations is more than a prudent risk with the current temper of the market.

Wm. F. Stuart



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To help you and your customer plan complicated wiring systems or solve difficult wiring problems, a Graybar Inside Construction Specialist is available for consultation. His recommendations, supplementing those of your local Graybar Representative, will help to speed up performance of your contract from start to finish.

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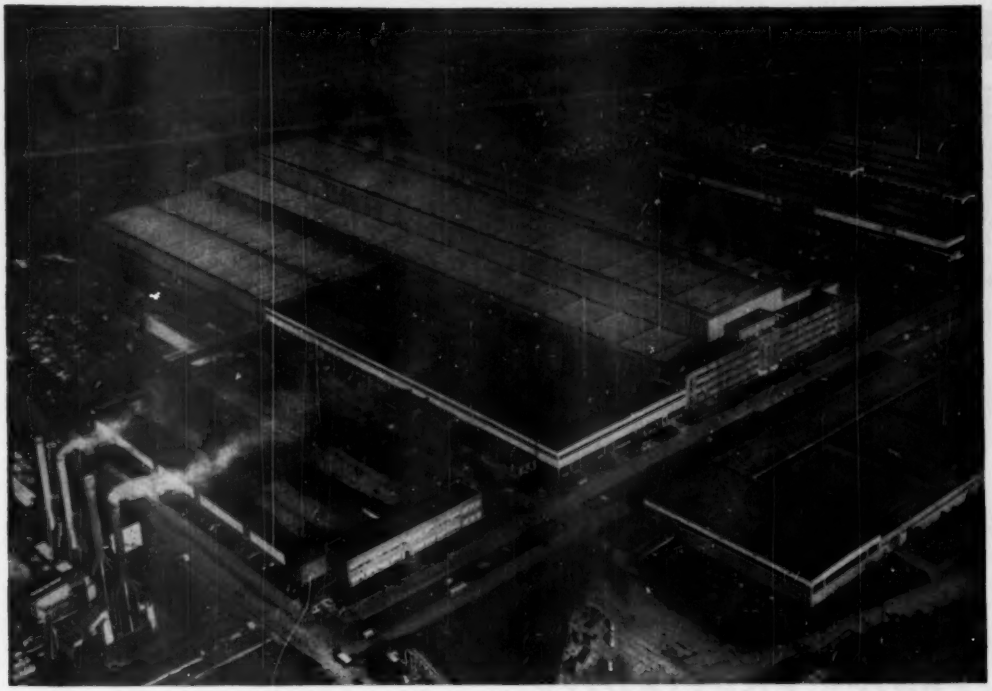
Graybar offers you similar service for all your other electrical needs. For dependable supplies and for help in speeding lighting, communication, ventilation, and other electrical installations, call our nearest office. *Graybar Electric Company, Inc. Executive offices: Graybar Building, New York 17, N. Y.* 4938

IN OVER 100 PRINCIPAL CITIES



MAMMOTH TURBINE PLANT, ***producing turbine-generators having capacities up to ¼-million kw., operates on electrical framework installed by Watson-Flagg.***

G. E. — of SCHENECTADY

Underground distribution, secondary-selective unit substations, the use of new materials and modern construction techniques make this installation a jam-packed example of practical, usable installation methods.

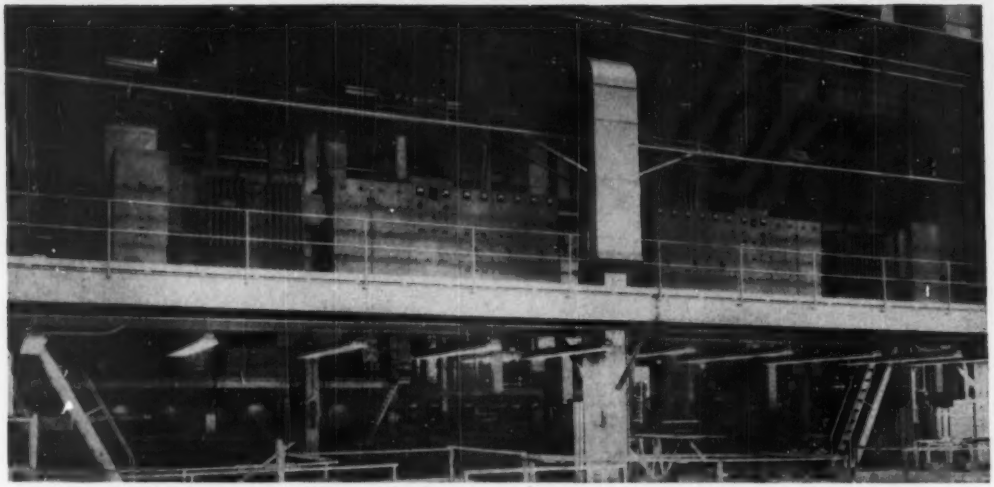
By Vreeland Flagg *Vice-President, Watson-Flagg Engineering Company*

GENERAL ELECTRIC's steam turbine plant in Schenectady, New York—a $30,000,000 investment containing a million square feet of manufacturing area—is a tremendous testimonial to dual electrical distribution, the application of modern electrical materials and equipment, industrial safety practices and exacting production methods.

Two factors make the plant impressive to electrical construction men.

First, its physical size and scope; for it can be described by mentioning 8 secondary-selective unit substations, a machine-tool load of 20,000-kw., 10,700 lighting fixtures, a million-volt X-ray machine, 51 traveling cranes ranging to capacities of 200 tons with 61-foot clearances, 8¼ miles of ventilating duct and 3½ miles of 2-gage railroad track connecting the various plant areas.

But second, and more significant; the plant demonstrates a variety of methods, applications and techniques which can be applied advantageously not only to mammoth electrical installations such as this but to hundreds of more recurrent medium-sized projects as well. It is a carefully engineered large-scale summation of practical, usable every-day practices.



ELEVATED UNIT SUBSTATIONS *are located at load centers with primary voltage carried to these double-ended secondary-selective unit substations through underground multi-cell ducts. Eight unit substations serve the plant; two of them supplying 250-volt d-c through sealed ignitron mercury-arc rectifiers having continuous capacities of 2000 amperes. All a-c substations have grounded-neutral 600-volt secondaries.*

SERVICE CONTINUITY

Incoming service to the 20-acre plant is underground with four 13.8-kv., 3-conductor feeders carried inside the building lines through 4-inch Transite ducts sheathed with reinforced concrete envelopes. Two of these feeders (600 MCM) proceed underground to a cable vault beneath the main 13.8-kv. metal-clad switchgear switching station and rise to ground-level switchgear through 3-inch conduits bushed above and beneath floor slabs to anchor the sleeves and protect the cables. The remaining two 3-conductor feeders are carried underground for a greater distance to a second 13.8-kv. metal-clad switchgear switching station located in the testing section of the plant.

The main switchgear is a sectionalized bus installation with the north and south bus sections separately served through electrically operated 1200-amp. circuit breakers. These two sections are tied together through an electrically-operated 1200-amp. circuit breaker so that, in an emergency, switchgear connected to both sections could be served by either main feeder.

Service continuity is further insured by radial feeders that radiate from this switchgear to unit substations strategically located at plant load centers. These double-ended unit substations are of the secondary selective type with the two sections separately served by individual transformers fed from different sections of the 13.8-kv. switchgear. In all, there are 5 a-c and 2 d-c unit substations connected to the main switching center in this manner while the eighth unit substation (a-c) is similarly served by a second 13.8-kv. switchgear installation. All a-c unit substation transformers are rated 1500-kva. with 600-volt wye-connected grounded-neutral secondaries. D-c units have 588-kva. ratings with 250-volt rectifiers.

Since the two sections of each low voltage unit substation are linked by manually operated tie circuit breakers, the entire bus could be served by either transformer should the necessity arise. This secondary selective radial system, coupled with the previously mentioned sectionalized arrangement of the main switching station, provides each substation bus with 4 possible connections to incoming service lines.

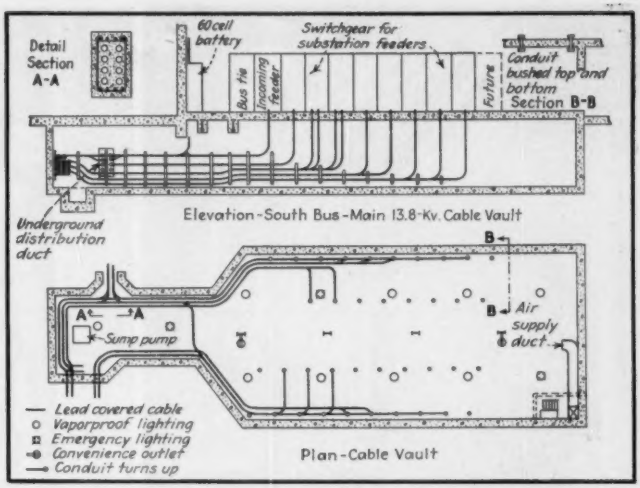
Carried underground at 13.8-kv., the primary system incorporates simplicity, reliability, flexibility, freedom from excessive maintenance, low first cost and adequate delivered voltage. The selection of 13.8-kv. for primary distribution has several important economic and operational advantages, for less copper is required to transmit given amounts of power, fewer circuits are required, voltage drop is minimized, and 15-kv. switchgear can be utilized effectively. Since some of the underground feeders extending from switching centers to substations exceed 1800 feet in length, the factors of voltage drop and cable size are readily recognized.

Substations are located on elevated platforms; an arrangement that places substations close to load centers while leaving working areas free for production and safeguarding both equipment and personnel from accidental injury. Safety is also promoted through the installation of ship-ladder stairways to these elevated substations, subway-grating platform flooring, heavy guard rails and thorough grounding of all equipment and material.

In normal operation, the tie breaker between the two sections of each substation remains open with the two sections operating independently. This breaker is interlocked with the two transformer breakers so that it cannot be closed unless one of the transformer breakers is opened. This is done to prevent paralleling of units, keeping the short-circuit duty on the secondary circuit breakers to a minimum.

If a fault should ever happen to occur in one of the primary cables or transformers, the associated primary

CABLE VAULT *beneath main metal-clad switchgear switching station is temperature and humidity controlled; is lighted by vaporproof units.*

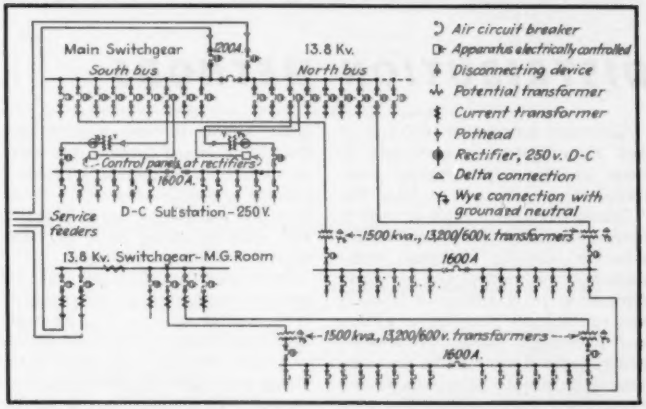


MAIN METAL-CLAD SWITCHGEAR *switching station is sectionalized bus installation with separate service feeders bringing 13.8-kv. current to the two bus sections. Bus sections are tied together through electrically-controlled circuit breaker, providing for emergency switching of power.*

feeder breaker trips, interrupting service to the load. However, service can be restored quickly by opening the secondary circuit breaker of the faulty circuit, and closing the bus tie breaker to pick up all loads connected to the substation through the remaining transformer. Under these remote conditions, one transformer of a double-ended substation would either have to carry the entire load of the 2-section substation, or some non-essential load dropped. Some spare transformer capacity is provided for this purpose and to care for load growth. This spare capacity has a beneficial effect upon voltage regulation.

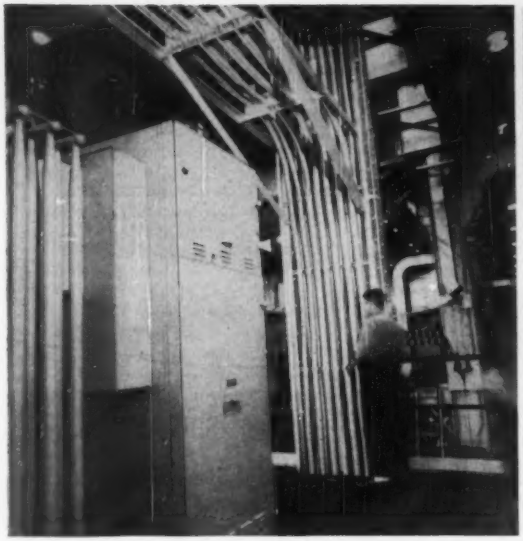
Fire protection is also stressed at substations with transformers using non-combustible Pyranol (askarel) rather than oil as a cooling and insulating liquid. While these transformers are designed for handling emergency overloads and coping with unfavorable ambient-temperature conditions, added capacity is further guaranteed through the inclusion of fans in the assemblies for forced-air cooling.

Other safety factors include enclosed potheads (likewise a fire-prevention expedient) and draw-out air circuit breakers that permit inspection or replacement with maximum safety to maintenance personnel.

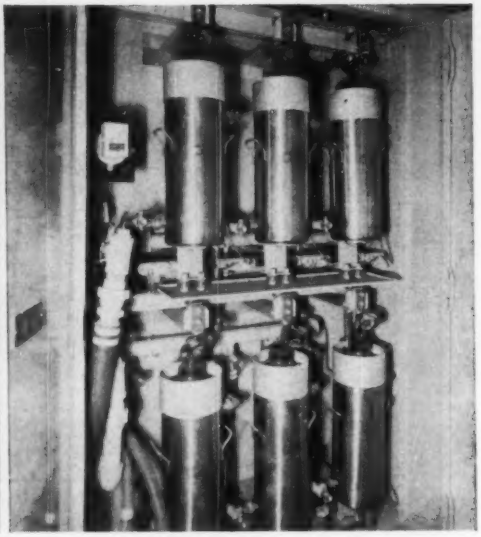


SCHEMATIC WIRING DIAGRAM *shows features of secondary selective system. All high-tension wiring, from service entrance to main switchgear and from switchgear to substations, is carried underground. All substations are double-ended, having two transformers.*

While primary distribution and most of the secondary demand is a-c, there is considerable call for direct current to operate cranes and certain production equipment. To supply this d-c demand, two of the secondary-selective substations incorporate sealed ignitron mercury-arc rectifier sections as well as transformer and switchgear sections. With no moving parts and with 3-phase full-wave provisions (double wye with grounded neutral on the secondary side) the units are proving reliable and economical with power factors better than 90 percent and operating efficiencies about 92 percent. The ignitron tubes, with continuous capacities of 400 amps. each, are cooled by distilled water maintained at normal temperatures through the use of heat interchangers operating on the shop water system. Water is taken from the river, hence, is not suitable for direct use in the ignitron tube cooling circuit.



INTERLOCKED ARMOR CABLE *is used to connect substation switchgear with secondary feeders, transformers and crane trolleys. Unistrut mounting is widely utilized.*



MERCURY ARC RECTIFIER, *rated 500 kw., provides 250-v d-c for manufacturing and testing areas. Front view shows sealed construction, cooling system and power connections.*

DISTRIBUTION METHODS

Secondary distribution (600 volt a-c and 230-volt d-c) is essentially by three methods; open wiring, interlocked armor cable and enclosed bus.

Interlocked armor cable is used to connect substation switchgear with distribution circuits, lighting transformers, crane trolleys and bus ducts. Because of its flexibility, it is easily and conveniently strapped to girders and messenger cables. It provides better mechanical protection than nonmetallic armor cable, it permits positive grounding, and resists corrosion. Economically as well as from an installation viewpoint, it is definitely satisfactory for its designed purpose.

Busways serve 4 of the plant's 20 acres of manufacturing floor space, carrying a-c and d-c along opposite sides of column lines in the areas so served. With a variety of standard tees, elbows, interchangeable plugs and breakers, the system can be altered to meet changing manufacturing demands or loading conditions.

Flexibility of installation prompted the extensive use of Unistrut metal framing for supporting interlocked armor cable, lighting fixtures, control panels and switch boxes throughout the plant. Giving strength without bulk, the adjustable and reusable steel channels with their continuous slot made it possible to position and secure equipment and material by merely inserting and securing spring nuts and bolts without drilling or welding.

Installation practices for both a-c and d-c branch lines are uniform in all turbine plant sections. For example: (1) Branch lines to individual devices or groups of devices are tapped to the distribution mains by mechanical connectors. (2) Lines are run in metallic conduit, the size of the conductors being determined by the load to be carried rather than by the size of the supply mains. (3) Lines supplying more than a single electrical device terminate at group fused safety switches or air circuit breakers, with lines from this group switch or breaker run to individual fused line switches of the separate devices. (4) Branch lines supplying single devices terminate at fused safety switches or air circuit breakers located on the building column nearest to the tap. Where devices are relatively near these columns, the switch or breaker is used as the main line switch for the device. However, if the distance is great, an additional main line switch or breaker is located directly at the device. (5) Lines supplying lighting transformers located in the upper building steel are protected by fused safety switches located at the tap. (6) Fused safety switches or air circuit breakers mounted on building columns are located 6 feet above the floor.

All large cables (2/0 and larger) carrying 600 volts are varnished cambric braid and interlocked armor. Smallar cables are generally Flamenol. Terminals are clamp type.

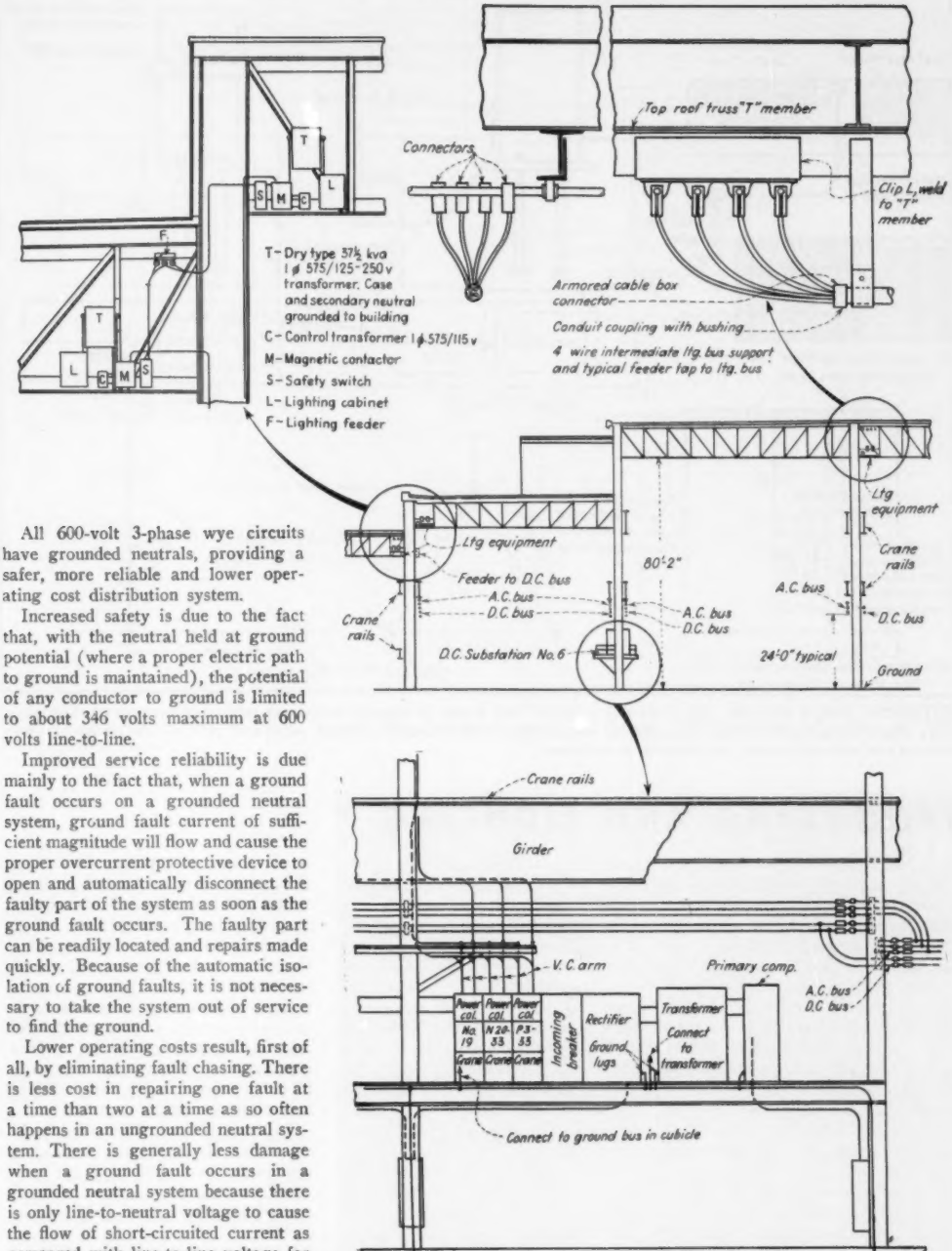
To provide both insulation and mechanical protection to wiring splices with a single tape and with a single operation, electrical tape with vinyl plastic backing is widely applied. In addition to saving time and material, these splices occupy considerably less space, permitting maximum use of junction boxes. Since the vinyl plastic backing has a high resistance to water and oil, has considerable elasticity and resists abrasion, it is particularly good for splicing power extension cables on portable equipment where cables are moved along the floor and are subjected to the splash of oil or to rough usage.

All 600-volt 3-phase wye circuits have grounded neutrals, providing a safer, more reliable and lower operating cost distribution system.

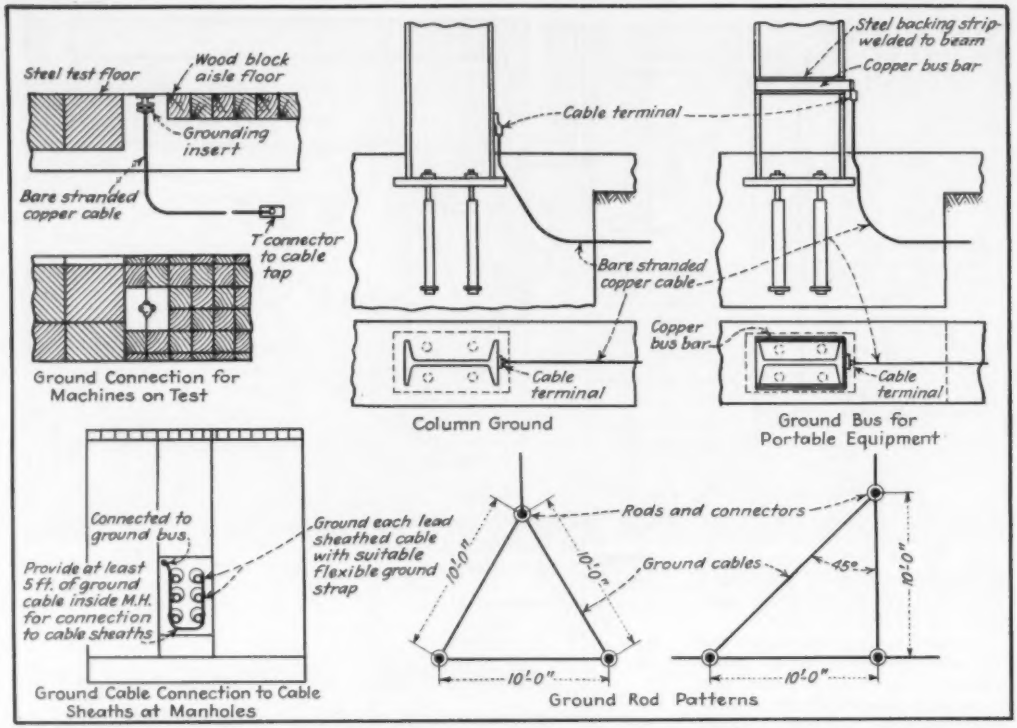
Increased safety is due to the fact that, with the neutral held at ground potential (where a proper electric path to ground is maintained), the potential of any conductor to ground is limited to about 346 volts maximum at 600 volts line-to-line.

Improved service reliability is due mainly to the fact that, when a ground fault occurs on a grounded neutral system, ground fault current of sufficient magnitude will flow and cause the proper overcurrent protective device to open and automatically disconnect the faulty part of the system as soon as the ground fault occurs. The faulty part can be readily located and repairs made quickly. Because of the automatic isolation of ground faults, it is not necessary to take the system out of service to find the ground.

Lower operating costs result, first of all, by eliminating fault chasing. There is less cost in repairing one fault at a time than two at a time as so often happens in an ungrounded neutral system. There is generally less damage when a ground fault occurs in a grounded neutral system because there is only line-to-neutral voltage to cause the flow of short-circuited current as compared with line-to-line voltage for a double line-to-ground fault. The lower current may result in less burning and hence less damage to repair.



SECTIONAL DRAWING *through 2 of 10 industrial bays indicates location of typical platform-mounted d-c substation, both a-c and d-c distribution bus, lighting transformers in overhead trusses and crane rails.*



GROUNDING *rods, 8 feet long and ¾-inch in diameter, are buried at frequent intervals in groups of three; are connected to 20-acre grounding network through bare stranded copper cables. All structural columns, permanent and portable equipment, machines on test and cable sheath are grounded as indicated.*

GROUNDING AND LIGHTING

For the safety of personnel, the proper operation of overcurrent devices and the prevention of damage to equipment, frames and metallic enclosing cases of all electrical equipment and electrically operated equipment are thoroughly grounded. In many cases, equipment is bolted or welded directly to the steel framework of the building which, in turn, is grounded. Where equipment is not securely attached to building steel however, individual ground connections are carried from the equipment either to the building frame or to the nearest permanent water pipe.

Stranded copper grounding connections and copper straps generally are equal in size to the largest conductor in the line feeding the equipment, but in no case are these connections smaller than 6 gauge or larger than 4/0. Where power is brought to equipment through conduit or raceway, ground connections are run on the outside of such channels and are mechanically protected against damage.

Portable equipment is also grounded, through a ground wire in the connecting flexible cable. Where equipment operates at above 125-volts, this ground wire is connected to a grounded pole or contact in the plug or receptacle. However, for lower voltages, the ground connection at the plug end of the lead is established through a spring clip which is attached to the nearest metallic ground.

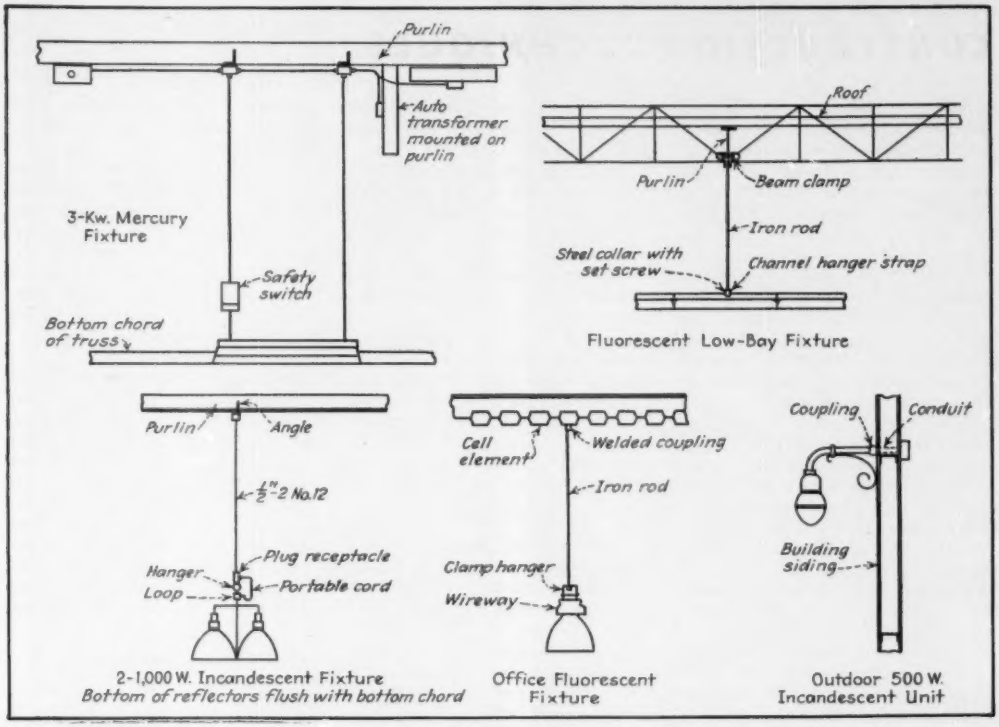
The ground grid beneath the plant includes over 4 miles of bare stranded copper cable in a grid pattern, with the grid connected to over 200 8-foot ¾-inch copper rods driven into the ground in groups of 3 on approximate 180-foot centers. Except where taps to equipment, narrow gage railroad, and columns extend through the floor slabs, the ground system inside the limits of the plant is buried beneath all concrete.

Underground primary feeder cables are grounded at all manholes, with a flexible ground strap connected to each lead cable sheath.

These methods for grounding apply generally throughout the plant, with specially designed grounding systems installed on such heavy-duty equipment as power transformers over 100-kva. and substation installations.

Lighting in the turbine plant can be divided into five categories: production area high-bay incandescent and mercury, low-bay fluorescent, plant-wide emergency, office area and exterior lighting.

In the two central bays, with lower chords of roof trusses at an 80-foot elevation, lighting units are suspended flush with bottom chords in a pattern



LIGHTING *includes 3-kw. mercury units for high-bay plant areas, both 1000-w. incandescent and 400-w. mercury fixtures for intermediate heights, 500-w. incandescents for exterior illumination and continuous 40- and 100-w. fluorescent assemblies for office and low-bay plant sections.*

measuring roughly 20 by 26 feet on centers and with units so staggered that, in either direction, each mercury lamp is separated by 2 incandescent fixtures. Each incandescent unit contains two 1000-watt 125-volt PS52 mogul base lamps, suspended through hangers, loops, receptacles and 12-gage drop chords from angle irons welded to roof purlins. Each mercury unit contains a 3-kw. AH9 clear lamp and fixtures are suspended through 575-volt a-c 30-amp. safety switches from roof-mounted condulets. Units operate through enclosed 3-kw. 331-volt 60-cycle autotransformes mounted to purlins. Lighting intensities. on the working plane 80 feet below the units, average 40 footcandles.

Fixture maintenance and lamp replacement is by means of platforms erected on the rolling cabs of upper-level cranes serving this huge area.

MERCURY AND INCANDESCENT *lighting, mounted 80 feet above the working floor, provides 45 footcandles of general illumination throughout the high-bay areas.*

CONSTRUCTION TECHNIQUES

Several installation methods and techniques utilized during construction were developed primarily to conserve manpower and to promote safety and efficiency under conditions of unusual heights and distances, wide variations in current characteristics, extreme weights and tight working schedules necessary to meet progress deadlines. For example: the factor of height resulted in the development of three methods contributing to the installation of interior high-bay and exterior lighting equipment and to both indoor and outdoor crane trolleys.

Since the two main 91-foot-high bays covered areas measuring 80- by 1290-feet, it was apparent that a large elevated working area would be required by men installing lighting outlets on roof purlins, dry-type transformers on overhead trusses and feeders between truss girders. This resulted in a major scaffolding job, with a plank floor measuring 80- by 160-feet suspended beneath lower roof-truss chords by means of steel stirrups. Since spans between trusses were 20 feet, floor sections were constructed in these lengths and the suspended scaffolding was moved forward as the work progressed. The installation of outlet boxes, conduit straps, junction boxes and transformers for the mercury lighting units were further speeded by the use of stud welders, eliminating drilling, tapping or bolting.

Rolling Scaffold

A second type of working platform was specially designed to facilitate the installation of crane trolley rails and the necessary mounting brackets. Since at the time of this installation the plant floor was unfinished and pock-marked wtih machinery foundation pits, and since trolley heights were from 50 to 80 feet above the floor level, standard platforms were impractical. However, a rolling scaffold was definitely required so a 2-wheel truck assembly was constructed, connected by tie rods and equipped with offset yokes. With the trucks rolling along the tops of crane girders and a standard painters' scaffold suspended beneath the girders from the lower ends of the yokes, electrical workers could work in safety and regulate their elevation in accordance with their needs. From these rolling scaffolds crews progressively installed angle iron brackets, insulators, framing angles and crane trolley bus rails.

The third elevated scaffolding method made use of the gantry crane which was track-borne along the northern exterior of the building. Before permanent trolley rails were installed for this crane, temporary power was supplied through drag cable feeders connected to outlets located at various building column lines, with the connections being shifted as the crane was moved along the track. Working from a scaffold built on the end of the crane the men positioned insulator brackets required to support figure-8 trolley wires and floodlighting units on the building's exterior surface.

Prefabrication

The amount of electrical material used for these crane trolley installations made production-line operations definitely advantageous and, to cut and drill angle irons and the 22 tons of copper bus required for interior crane rails, fabrication shops were set up and moved from time to time to keep pace with installation progress. These shops were equipped with jigs, punches, drills, shears and power tools for maximum efficiency.

Prefabrication methods were also used in connection with lighting load centers, for safety switches, control panels and transformer brackets were assembled as complete units and fastened to angle iron frames before being hoisted from the ground to their roof-truss locations where they were welded into position. After these frames were secured, transformers were likewise raised and installed.

In the test area, two methods were devised in connection with power distribution. The first of these is a ring-bus distribution center designed for the six types of current used (575-, 440-, 220- and 110-volt 3-phase 60-cycle; 125/250-volt d-c, and a variable frequency 3-phase supply).

Ring busses are supported by insulators connected to the top of a steel drum housing and cables enter the drum through the top center, conductors being connected to the desired phase rings by means of bus clamps. When all connections are made, a circular cover plate is raised to seal the bottom of the drum and, after clamping the cover in place, the entire drum assembly is lowered into a manhole-based iron frame.

The second test-area method to be mentioned is an interlocked bellcrank control for the gang operation of both single and double-throw disconnecting switches. Switches for controlling connection boards and plug-in devices are tower mounted; power cables are carried inside the tower up to the switches, and bellcranks are key-interlocked for operational safety.

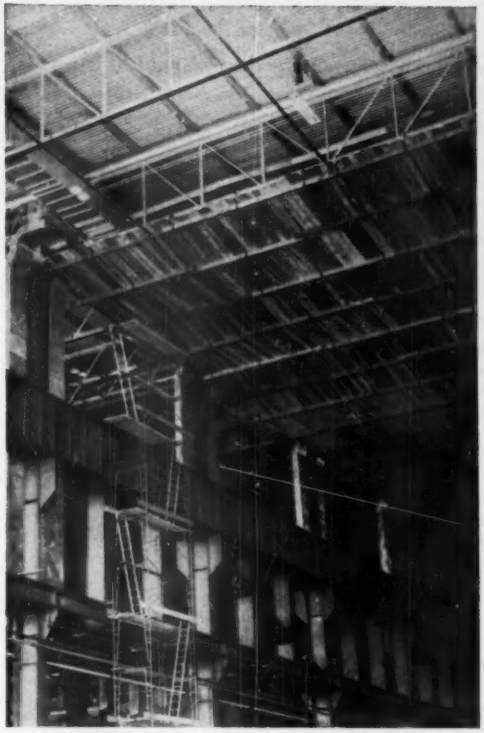
In the manufacturing sections there is nearly as much steel below ground as there is above for, with a boring mill, having a 40-foot diameter, heavy machine tools, testing equipment and concentrated loads weighing up to 400 tons, even slight settlements of foundations in testing and production areas could have serious results. Construction data reveals that 14,000 tons of structural steel are above ground while 13,000 tons of steel piling supports this mass.

Stainless Steel Exterior

Another construction innovation is the stainless steel exterior cladding on the office section. The cladding consists of prefabricated 20-gage fluted front sheets backed by 1½ inches of glass fiber insulation and flat 18-gage carbon steel base sheets. Not only is this exterior beautiful and resistant to corrosion but, because of weight reduction, one more floor than originally planned could be added without exceeding the bearing qualities of the foundations. This stainless steel construction has increased floor space, speeded construction, minimized erection and maintenance problems.

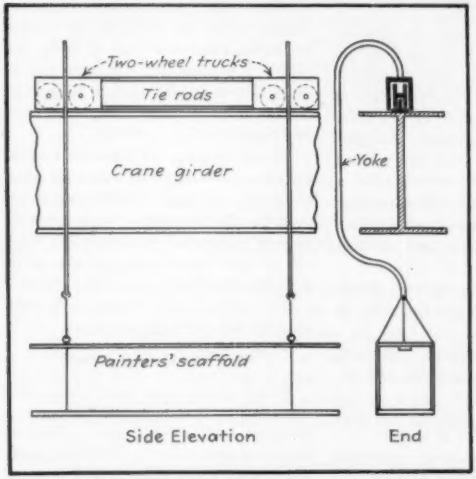
In this mammoth plant where new products and modern construction and installation techniques are so clearly evidenced, G. E. engineers are successfully meeting and solving turbine design problems connected with high temperatures (over 1000 degrees), high speeds (blade periferies at 600 mph), high pressures (2300 psi) and internal vibration.

This exacting research, development and production calls for facilities of a high order; facilities which have been provided in an outstanding manner by architects-engineers-constructors Stone and Webster, and by electrical-contractors Watson-Flagg.

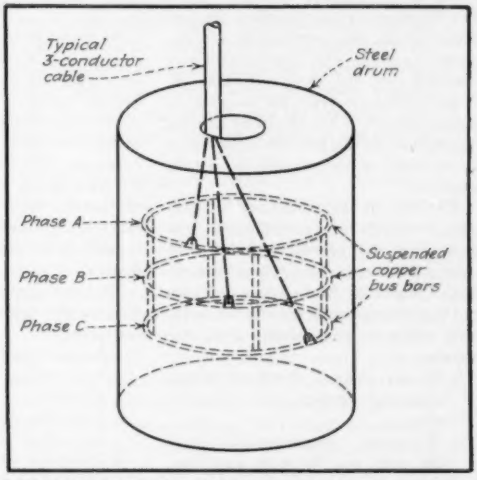


SCAFFOLDING, *extending 80 by 160 feet and shifted as the work progressed, provided safety for electrical workers who installed lighting outlets, dry-type transformers and feeders at purlin level 91 feet above the floor.*

MAINTENANCE *and relamping of fixtures is effected from special safety platform erected above control cab of upper crane. Ample working area and waist-high railing protects maintenance crew working at these 80-foot elevations.*



MONORAIL YOKE SCAFFOLDS *were constructed to operate along the crane girders so that electrical workers could install trolley bus and brackets before the plant floor was surfaced and without the necessity of using ladders or platforms.*



RING-BUS JUNCTION BOXES, *used in the test area and located in special manholes, permitted cables to enter through the top, with clamp connectors linking individual conductors to the desired phase.*

How To Estimate Electrical Work—II

TAKE-OFF REQUIRES competent and experienced visualization, literally doing the job mentally.

TAKE-OFF REQUIRES detailed analysis and segregation of separate components and parts.

TAKE-OFF REQUIRES accurate counting and measuring of all significant elements.

TAKE-OFF REQUIRES systematic listing and summary of quantities.

By W. T. Stuart

TAKE-OFF is the first critical phase of electrical estimating. It involves three distinct operations, each of which contains the risk of possible errors, but which are performed almost simultaneously. They are:

1. Visualizing
2. Counting
3. Listing

Visualizing is largely a subjective process. It includes the steps the estimator takes to understand or mentally construct the finished job from the available data. It may be a simple process as in the case of a residential wiring contractor noting the plan of a conventional small frame house. There may not be so much as an outlet indicated, but from experience with the builder, the type of project and prevailing standards, he will readily visualize the finished electrical work. For the more elaborate project, the estimator reads the specification and explores the plans. Full visualization may not come until well along in the take-off. Many estimators begin the counting or actual take-off on branch circuit lighting outlets because this provides quick access to the scope of the job and the details involved.

The process of visualizing depends almost entirely on the estimator's job experience and general knowledge of construction operation. There are no known shortcuts, but a systematic plan can expedite the work. On smaller work, with little or no available data, for instance:

1. Always make a sketch or wiring diagram (whether it is needed or not).
2. Write out a rough specification of the scope and the more significant details of the work required.

For larger projects involving plans and specifications, the visualizing plan can be laid out as a precise routine as:

1. Read the specification through.
2. Explore the plans, noting major features (service entrance, equipment locations, etc.)
3. Go through specifications again. Make notes and take off major equipment items. (for special quotation, etc.)
4. Take off branch circuit work, and so on.

Since we are dealing here with a subjective process, one that is leading up to an understanding of the job, individuals will find their understanding aided by different methods. The important thing is, once a routine has been set up, to follow it until it becomes habitual.

The visualizing process is given special emphasis here because it is a phase of estimating method which is often ignored or under-emphasized. In actual estimating work inadequate visualizing can lead to gross errors.

Counting

An electrical construction job, whether it is wiring a small town parking lot or wiring the Empire State Building, spreads out like a tree. The roots are in the service entrance, the trunk is a main feeder, flowing into branches. Complex networks, dual distribution and control interlocking may provide variations from the analogy but, on the whole, energy flows along a line from point to point, branching to utilization and control devices.

The electrical system consists, therefore, of the following general types of materials:

1. Prefabricated equipment requiring more or less job assembly and installation.
2. Materials designated by type and size and measurable by length.
3. Materials designated by type and size and measurable by number.

In take-off, the first group requires not only the quantity but discrimination as to particular features of the equipment. For example, this category would include panelboards. A simple count, say 10 panelboards, would give little useful data for estimating. The estimator must also note the make, cabinet and trim, flush or surface mounting, number, type and size of circuits, type and size of mains for each panel.

This group will include:

Special service equipment
Switchgear
Transformers
Switchboards
Panelboards
Large pull boxes
Gutters and special raceways
Controller assemblies
Motors, generators and converters
Special lighting fixtures
Heaters and other utilization apparatus
Signal and communication equipment
Terminal and cross connect boards
Special device combinations

The second group includes those materials which are available in a range of sizes, standards and qualities, but which are measured, handled and installed in terms of length. It includes such items as conduit, tubing, cable, wire and busbars.

The third group includes the vast array of specific electrical materials which terminate runs and provide access and control. They are items which are available by designation and quantity. Typical of these are wiring devices, meter switches, bus plugs, standard fixtures.

Two special tools are especially valuable for the counting operation.

The Measuring Wheel

Branch circuits and feeder runs can be measured by a scale or flexible ruler. A fine steel tape is used by some estimators. Most, however, use a small watch-like device with a projecting wheel. This instrument is known as a "rotometer" or map measure. A typical instrument is about 2 inches in diameter, reads 12

inches with one revolution of the large hand, two small dials extend the reading to 10 feet and 100 feet respectively. A button on top resets the reading to zero.

The measuring wheel is by far the most convenient method of measuring conduit or cable runs. With some care and practice it is closely accurate. Runs can be accumulated on the dials. Attention can be devoted entirely to the plans.

The wheel is held in the right hand between the thumb and two fingers, the thumb *always* on the dial side. It is held lightly but firmly on the line to be measured and moved at a speed of not more than 6 inches a second, *always* in a direction *away* from the wrist.

Developing a habit of always handling the wheel in exactly the same way is important. The wheel can be run in either direction; moved backward the measure would be subtracted from the accumulated total. In measuring circuits, the estimator must give his closest attention to the plans and checking. The mechanics of handling the wheel should be automatic and so set by invariable habit that it will always accumulate in the forward direction.

Some estimators advise that resetting should always be done with the left hand to avoid accidental or careless resetting while measurements are being accumulated or before figures have been listed.

The "rotometer" is a precise instrument and deserves the best of care. The estimator should always use his own wheel with access to a spare. However uniform they are in appearance and makeup, each has its own "feel" which in familiar hands gives warning of any defects in the mechanism. An occasional check of the wheel on a measured line is a good precaution.

When the instrument is broken, damaged, or worn, it is safest to discard it and replace it with a new one. Repairs are often unreliable.

How to Measure

On branch circuit work, the estimator identifies each run of conduit with conduit or cable size and the number of wires. Runs of the same kind, i.e., 2 No. 12's in ½ inch, 4 No. 12's in ¾ inch, etc., are measured individually and accumulated on the dial for each floor or selected area. As each run is measured, it is checked off by means of a colored pencil on chalk held in the left hand. Vertical runs up or down to wall outlets are measured on an elevation line drawn at the side of the plan. The elevation line shows ceiling and floor lines, and the height of each type of outlet to scale.

Feeders are usually taken off individually, a separate measurement for each circuit. A riser diagram with vertical measurements to scale is a useful and often essential aid to accurate take-off.

Tally

The tally is a small round instrument with the number wheels behind a window. A projecting operating bar moves the "ones" wheel one digit each time it is depressed. It is usually held in the left hand with the retaining ring over the second finger and the bar depressed by the thumb. A three figure tally comes to a total of 999. Reset knobs on the back restore the setting to zero.

The use of the tally is relatively uncomplicated. With experience its operation becomes practically automatic. Many estimators carry a mental count along with the tally as a check. An important advantage of the tally over mental counting is that it permits interruption or momentary diversion without risking the accuracy of the count or loss of accumulated data.

ELECTRICAL ESTIMATING by Ray Ashley

McGraw-Hill Book Company—$6.50

Ashley's work is easily the most important new book in the electrical construction field in a decade. It is 1) a thoroughly authoritative and comprehensive job 2) on a subject of timeless but immediate importance to practically everyone in the management level of the electrical construction industry and 3) written by a top-flight authority in the field.

This reviewer, from a background of many years hunched over the estimating board, found the book as absorbing as a novel and as practical as a slide rule. Ashley is very much at home with his subject. Although the project is stacked high with facts, figures, methods and examples, the essentially human and creative aspects of the estimator's work, "the personal problem of long hours over the board under the strain of large responsibilities," are never overlooked.

The book is written directly for the contractor, estimator, engineer or student who must solve complex problems of estimating, appraisal, cost accounting, job scheduling, or supervision as part of his daily affairs. The student engineer will find it an authoritative and comprehensive textbook. The senior estimator will find it an absorbing and useful reference work.

Like a good estimate, the book is thoroughly detailed. It covers the selection and training of estimators, his tools and surrounds, the design and use of forms, the preparation of estimates from the preliminary specification study to the recap sheet, and the all-important influence of operating costs on bidding practice.

One of the most valuable and instructive features of the book is the section on sample estimates. By actual example, the author takes the reader through jobs in full detail; the specification with margin notes, the plans and details, and the complete estimate on the original take-off, summary and pricing sheets.

If the correspondence of this office is a criterion, Ashley has provided a work on a subject of compelling importance in the electrical construction industry today. And it has been done very well. Beyond its own substantial worth as a source of much needed practical data, it can have an important influence on the future course of the industry. To quote from the author's introduction, "In the long history of electrical construction, accurate methods of estimating and appraisal have evolved slowly. The source material is buried in the files, notebooks and memories of individual estimators. A few who have sought out their contemporaries for a frank exchange of data and method have found it richly rewarding."—W.T.S.

How the Nine Major Market Areas Shared in 1949 Appliance Sales

Region	Resid. & Rural Electric Customers	% of U. S. Total	Shipments by Percent of U. S. Total (first eight months) Washers	Ironers	Refrigerators	Ranges	Water Heaters	Freezers
New England	2,609,200	7.01	5.31	5.04	5.25	5.72	6.08	3.43
Middle Atlantic	7,908,400	21.23	18.31	17.39	16.93	13.22	15.61	12.70
East North Central	8,062,900	21.65	20.45	24.91	17.00	18.67	20.27	22.53
West North Central	3,536,800	9.50	9.69	11.38	11.32	10.38	12.02	16.07
South Atlantic	4,482,100	12.03	14.00	8.79	14.91	21.25	20.91	12.69
East South Central	2,265,900	6.08	7.61	3.09	9.45	12.40	7.66	6.36
West South Central	3,172,200	8.52	9.85	8.04	13.78	3.84	2.55	12.96
Mountain	1,213,100	3.26	3.46	4.57	3.34	4.47	5.29	4.92
Pacific	3,993,500	10.72	11.32	16.79	8.01	10.05	9.61	8.34
Total U. S.	37,244,100	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Figures from *Electrical Merchandising*.

BRIGHT OUTLOOK FOR APPLIANCES

Despite 1949 Sales Declines

By Robert W. Armstrong
Managing Editor, *Electrical Merchandising*

Sales recovery in last six months, intensified promotions, utility help, high national income, potentials of clothes dryers, television, and dishwashers point to an active, busy 1950

DESPITE consumer skittishness, coal and steel strikes, bad production guesses, uncertainty about government controls, the return of real selling competition, and substantial sales declines from the 1948 record levels, 1949 was a good year for the electrical appliance industry.

Dollarwise, total retail sales reflected an $811-million decline from 1948, with unit sales of individual appliances off anywhere from 7.6 percent (clothes dryers) to 37.1 percent (ironers), according to *Electrical Merchandising* magazine's 30th Annual Statistical and Marketing Issue. But, says the magazine, sales in most categories were ahead of all other postwar years and far exceeded any prewar year.

The sales slide actually began in the last quarter of 1948 with renewed application of Regulation W controls on credit. The early months of 1949 were marked by inventory liquidation, declining prices and a wait-and-see attitude on the part of consumers. The traditional spring selling season failed to materialize and many manufacturers cut back production. When consumers re-entered the market in late summer these same manufacturers were caught short. The last six months saw a continuing upswing in demand and, for some lines, a continued shortage of goods which was emphasized by the October coal strike.

Upturn Comes Too Late

The upturn in sales and inventories didn't come soon enough for most retailers to compensate for earlier months. As a result, many appliance totals were substantially below 1948. Among appliances requiring special wiring, ranges were off 34 percent; electric storage water heaters were off 33 percent; dishwashers were off 30 percent; garbage disposers were off 11 percent. Refrigerators, one of the last major appliances to catch up with demand, were off 6.6 percent; standard size electric washers slumped 27 percent; freezers declined 30 percent; roasters fell a substantial 48 percent; space heaters slipped 35.7 percent.

But not all items failed to come up to 1948 levels. A few even exceeded previous records and these, particularly television, up a thumping 166 percent, were responsible for actual increases in dollar volume reported by some dealers. Room air conditioners, profiting from a hot summer, registered their best year in history with sales of 95,500 units, up 24.8 percent from the 1948 figure of 76,500. Oil burners, stimulated by the coal strikes, climbed 20.8 percent to 550,000 units from 1948's total of 455,245 units. Both represent important wiring volume.

For many of the newer, less solidly founded retailers, 1949 was a tough year, as indicated by the decline in numbers. At the beginning of 1949 electrical utilities from a survey, estimated the number of dealers at 76.4 percent more than prewar. In January, 1950, the same companies reported only 40.4 percent more dealers than prewar, a drop of 36 percent. Despite this decline, the power suppliers have shown little disposition to reverse the trend to get out of merchandising. At the beginning of 1949, 53.3 percent declared they would not sell appliances in competition with dealers. This year almost as many, 51.2 percent, will not merchandise.

Prospects for 1950

Despite the many declines and few gains in 1949 sales, both manufac-

Comparison of Unit Sales and Retail Value of Appliances and Radios, 1948-1949

Product	1948 Number Sold	1948 Retail Value ($)	1949 Number Sold	1949 Retail Value ($)	% Change Units	% Change $
Air Conditioners	76,500	32,512,500	95,500	39,155,000	+24.8	+20.4
Bed coverings	675,000	29,025,000	440,000	16,500,000	−34.8	−43.1
Cleaners, vacuum (floor)	3,360,860	257,542,700	2,875,000	219,937,500	−14.4	−14.6
Dishwashers	225,000	61,875,000	160,000	44,000,000	−28.9	−29.9
Disposers, food waste	175,000	21,000,000	155,000	20,925,000	−11.4	−0.3
Dryers, clothes	92,000	20,720,000	85,000	19,550,000	−7.6	−5.6
Fans, attic & vent	325,000	20,050,000	304,500	18,340,500	−6.3	−8.5
Freezers, food	690,000	220,800,000	485,000	162,475,000	−29.7	−26.4
Heaters, space	1,300,000	16,900,000	835,000	9,602,500	−35.7	−43.1
Ironing machines	477,000	71,550,000	300,000	42,000,000	−33.0	−40.5
Oil burners	455,245	237,385,500	550,000	.....	+20.8	.....
Radio & television, total	18,475,000	1,283,112,000	11,475,000	1,296,127,000	−37.9	+1.0
AM receivers	15,900,000	642,042,000	8,000,000	306,800,000	−49.7	−52.2
FM & AM-FM	1,600,000	264,720,000	875,000	107,485,000	−45.3	−59.4
Television	975,000	376,350,000	2,600,000	881,842,000	+166.6	+134.3
Ranges	1,600,000	376,000,000	1,056,000	242,880,000	−34.0	−35.4
Refrigerators	4,766,000	1,239,160,000	4,450,000	1,134,750,000	−6.6	−8.4
Stokers, residential	76,504	26,227,100	25,990	8,888,100	−66.03	−66.1
Washers, electric						
Standard size	4,195,600	726,404,400	3,065,000	525,188,000	−26.9	−27.7
Small	306,000	11,934,000	100,000	3,600,000	−67.3	−69.8
Water heaters, storage	1,040,000	137,800,000	695,000	90,350,000	−33.1	−34.4
Water systems	650,000	89,050,000	500,000	78,900,000	−7.7	−11.4
Small kitchen appliances*	15,165,000	276,876,500	10,545,000	227,293,500	.....	.....
Other small appliances†	20,605,000	212,330,000	15,495,000	167,554,500	.....	.....

* Small kitchen appliances include blenders, broilers, coffee makers, hotplates, grills, food mixers, roasters, sandwich grills, toasters, waffle irons.
† Other small appliances include clocks, heating pads, irons, shavers.
Figures courtesy *Electrical Merchandising.*

turers and retailers appear to be optimistic about 1950 prospects. For reasons, they can cite $193.5-billion in disposable income, an annual rate of saving of $15.1-billion, and $174.8-billion of liquid assets in the pockets of consumers.

New Customers

Still another factor pointing to continuing high sales in 1950, is the addition of 2,039,640 new residential and rural power customers to the lines of the nation's power companies, a jump from 35,205,360 to 37,244,100, a moderate but important increase.

Most power companies plan substantial increases in their promotional efforts. In the survey for the 1949 issue, for example, only 42 percent of the responding firms said they would conduct specific campaigns on electric ranges. This year 86.6 percent will conduct such campaigns. Over 77 percent will run water heater promotions, as compared with only 42 percent last year. Approximately 75 percent will promote freezers, as compared with 40 percent in 1949. Dryers will be pushed by 42.3 percent, as compared with 25 percent last year. Perhaps even more indicative of intensified promotional work by the utilities is their answer to the question: "Do you foresee the need for campaigns to build load in the near future?" Of the 200 companies replying, 165, or 82.5 percent, said, "Yes." Insufficient power reserves have often been cited since the war as one major reason why many utilities discontinued such promotional efforts as free range wiring campaigns and this discontinuance was partly responsible for the 1949 decline in range sales. As power capacity increases, many utilities will return to this extremely helpful form of promotional assistance to retailers.

Leaders in the Line

Among individual appliances, one of the brightest futures is predicted for the clothes dryer. Although it is one of the newest of heavy appliances, requires special wiring for the electric models, and is still virtually unknown to many consumers, its 1949 sales were off only 7.6 percent, as compared with much larger declines for most other major items, indicating a rapidly growing consumer acceptance.

Sales gains can well be expected for dishwashers. The number of dealers handling this appliance increased 18 percent during 1949 alone, according to a survey made by Hotpoint, Inc. The same survey revealed that 19.8 percent of dishwasher purchasers bought food waste disposers at the same time and 15.2 percent bought ranges—two items which mean business for electrical contractors. An adequate supply of steel and expanded distribution are sure to have a beneficial effect on sales.

Volume Increase Expected

In general, the 1950 sales outlook is one of lower unit costs, but increased volume. The evident optimism in all branches of the industry in the face of 1949 declines is encouraging, but with it there is also a growing recognition of the fact that to be a successful year, 1950 must also be a selling year. As evidence, promotion and sales building efforts of all kinds appeared in ever growing numbers during the last quarter of 1949. Several manufacturers made more or less successful efforts to obtain and train salesmen for their retail outlets; others launched big-scale campaigns. Dealers themselves suddenly became more campaign conscious and tried their own sales-building stimulants. Outside selling returned in more than token quantities, partly as a counter agent to widespread discount selling.

All of these trends will become more evident this year, because out of them will come the increased volume which will keep 1950 profits high in the face of lower prices.

ENTERING AN ORDER *on the multiple-copy counter register. An "A" series of consecutive order numbers is used for repair work; a "B" series for new equipment.*

REPORT COPIES *of orders are kept in the shop for quick reference making it possible to quickly check pertinent data.*

A. C. KATER, *co-partner, Houston Armature Works, Houston, Texas.*

Simplified Motor Shop Job Control

To many motor repair shops, detailed paper work has assumed the status of a "necessary evil"—an item which adds to overhead costs and hence shades the profits that might be realized from the business. While good business practice demands that adequate records be maintained, this phase of operation need not be topheavy or cumbersome.

A number of shops use standard record systems; others develop their own or adapt or modify standard methods to meet their specific requirements. Among the latter is the Houston Armature Works, Houston, Texas. This organization, specializing in the repair and rebuilding of electrical equipment as well as the sale of new equipment, has adapted the conventional multiple-copy counter order register to a simplified job control system.

Key to effective job control is the sales order or job number. These numbers run consecutively and have done so long before the counter registers were installed. The sales order or job number appears on all copies of the forms, on the employees time cards (for time spent on job), on winding data cards, on requisitions for materials for that specific job, and on motor loan slips should a "loaner" be necessary while the motor is being repaired. Final and permanent job identification is provided by the sales order number being stamped on the motor nameplate, or on a special number plate added to the motor before it leaves the shop. Thus, should the customer call regarding the repaired unit, he need only give this number and all information and data regarding the job can be easily found in the motor shop files.

The job control system installed by A. C. Kater, co-partner with H. P. Woolley, of the Houston Armature Works, utilizes two groups of numbers: an "A" series for all repair work and used equipment bought for stock; and a "B" series for all new equipment stock and sales. The sales or job numbers on stock equipment new and used are placed on inventory sheets in a loose leaf book, filed under the horsepower rating or other description. This book or file is kept in the general office as a means of determining the current inventory and numbers are ruled off as sales are made.

The combination of the A and B series covering used and new equipment provides a complete catalog of the motor and equipment stock. These forms are filed by number serially in a loose leaf book, each form being removed and filled in to the purchaser and billing made therefrom. A separate book is kept on all consigned stock. A serial ledger of all order numbers is also maintained for quick reference on continuity and disposition

OFFICE FILE *of original orders is kept for a period of two years. White forms are repair work; pink, new equipment sales.*

BOUND VOLUMES *of all orders (500 to volume) more than two years old are filed on reference shelves according to order number sequence.*

Multiple-copy order forms cut paper work. Order number follows repair job from original entry to number plate on motor; ties in with inventory and parts requisition control at Houston Armature Works.

By August Eckel

CHECKING BOUND VOLUME *for order completed several years ago. Customer identified motor by job number stamped on motor nameplate.*

of each form. The original "A" form with the customer's copy, stapled together when used for repair jobs, are placed in a file on the timekeeper's desk; arranged alphabetically under the customer's name; and turned in to the office when completed.

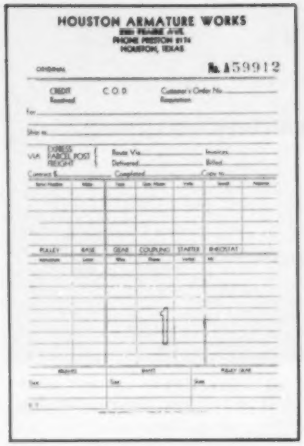
On small jobs, the labor and material is entered on the back of the original form. For the major repair jobs, requiring considerable quantities of material and labor, a supplementary card is made. This 10 in. by 11¼ in. card is really a totalizing sheet. On its face is the job number and the same data as on the original order, a detailed listing of materials used in the different departments and a complete summary of all material and labor costs. The back of the card carries a complete listing of labor used in the coil, winding, machine shop, assembling and testing departments as well as handling and miscellaneous labor hours.

Key to system efficiency is the multiple-copy form and its specific makeup (See Fig. 1). The upper half of each form provides space for noting customer identification; shipping instructions; when job was completed, delivered and billed; and selling price. The lower half is used for noting motor nameplate data, equipment that came in with the motor, size of brushes, shaft and pulley gear, all instructions and how received, as well as who authorized them. The same type of form is used for the new equipment sales "B" series, with the original copy being pink instead of white.

A substantial reduction in paper work is effected by the multiple-copy forms. The original entry, when the order is recorded, is all that is necessary. A sufficient number of duplicate copies (all 8½ in. by 5½ in.) are simultaneously made to meet shop requirements.

For the "A" series (repair work), four white copies are supplied. The original form stays in the office and ends up in a permanent file after pricing and billing. Two copies go to the shop; a Report Copy which goes to the department head for ready reference, and a Shop Copy which follows the job to the delivery department and then goes to the office as a clearance. A Customer's Copy is given to the customer as a delivery slip with the repaired motor. Where additional delivery slips are required, the Shop Copy may be used, or extra slips made out. The fourth copy remains in the register and is used as a final check to guard against possible loss of the original and Report Copies.

The original form (pink) of the "B" series sales order is kept for permanent filing after billing. The yellow customer's copy serves as a delivery slip, and the white second copy goes to


HOUSTON ARMATURE WORKS

2200 FRANKE AVE.
PHONE PRESTON 8174
HOUSTON, TEXAS

No. A 59912

ORDERED

CREDIT Received | C.O.D. | Customer's Order No. Requisition

For

Ship to

VIA: EXPRESS, PARCEL POST, FREIGHT | Route Via | Invoiced | Delivered | Billed

Contract # | Completed | Copy to

Serial Number	Make	Type	Gen. Meter	Volts	Speed	Amperes

PULLEY	BASE	GEAR	COUPLING	STARTER	RHEOSTAT

BRUSHES		SHAFT		PULLEY — GEAR	
Size		Size		Size	

P-T

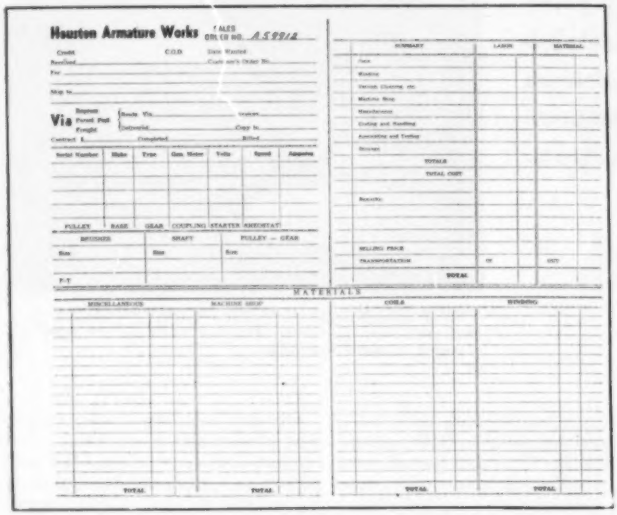
FIG. 1—*Typical order form in counter register gives complete information.*

the office for inclusion with the billing as an evidence of delivery; or in case of a cash sale, it is used as a record for identifying cash receipts. Another copy remains in the register for a final check.

Original copies of all orders, repair or new equipment sales, are kept for ready reference in file drawers for a period of two years. Then they are bound in stiff paper covered volumes (500 orders per volume) and placed on reference shelves, as a permanent record of all sales. These records date back to 1907.

Full technical data are entered on a Winding Data sheet (8-in. by 5-in.) which also carries the job number of the original order entry (Fig. 3). Should the customer require field service, the order is entered in the normal manner and a Trouble Report (Fig. 4) filled out giving the essential data covering the equipment inspected and service rendered. This form also carries the job number of the original order. If the equipment requires shop attention, it is brought in and the same job number assigned to it. These last few instances constitute the very few times that additional paper work, over and above that of the original order entry, is necessary.

For overall job control, Mr. Kater finds this system highly satisfactory and efficient. The job number ties together all operations and materials applied to a specific project. This number permanently stamped on the motor nameplate provides the customer with a quick identification of that specific unit and enables the motor shop to quickly uncover the complete case history of the repair work. Misunderstandings, incomplete data, and callbacks have been reduced to a minimum. It all adds up to increased customer service and satisfaction.


Houston Armature Works SALES ORD. NO. A 59914

Credit | C.O.D. | Date Wanted | Received | Cust. ord's Order No.

For

Ship to

Via | Express, Parcel Post, Freight | Route Via | Invoiced | Delivered | Billed | Contract # | Completed | Copy to

Serial Number	Make	Type	Gen. Meter	Volts	Speed	Amperes

PULLEY	BASE	GEAR	COUPLING	STARTER	RHEOSTAT

BRUSHES		SHAFT		PULLEY — GEAR	
Size		Size		Size	

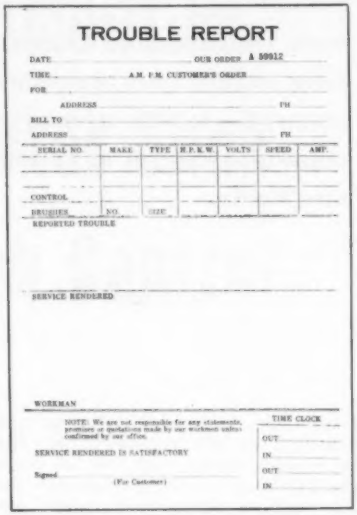
P-T

SUMMARY	LABOR	MATERIAL
Core		
Winding		
Varnish, Cleaning, etc.		
Machine Shop		
Miscellaneous		
Coiling and Handling		
Assembling and Testing		
Brushes		
TOTALS		
TOTAL COST		
Receipts		
BILLING PRICE		
TRANSPORTATION	OF	OUT
TOTAL		

MATERIALS

MISCELLANEOUS		MACHINE SHOP		COILS		WINDING	
TOTAL		TOTAL		TOTAL		TOTAL	

FIG. 2—*Supplementary summary card for major repair jobs lists detailed quantities of materials and labor used; carries repair order (job) number.*


TROUBLE REPORT

DATE | OUR ORDER A 59912

TIME | A.M. P.M. CUSTOMER'S ORDER

FOR

ADDRESS | PH

BILL TO

ADDRESS | PH

SERIAL NO.	MAKE	TYPE	H.P. R.P.M.	VOLTS	SPEED	AMP.

CONTROL

BRUSHES | NO. | SIZE

REPORTED TROUBLE

SERVICE RENDERED

WORKMAN

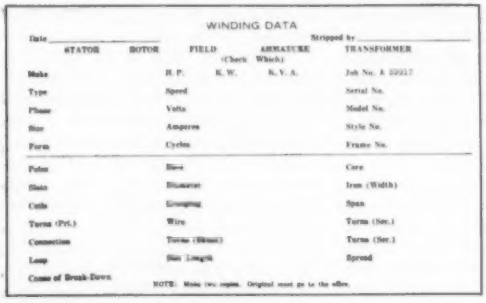
NOTE: We are not responsible for any statements, promises or quotations made by our workmen unless confirmed by our office.

TIME CLOCK
OUT
IN
OUT
IN

SERVICE RENDERED IS SATISFACTORY

Signed (For Customer)

FIG. 4—*Trouble report form for field service or trouble shooting.*

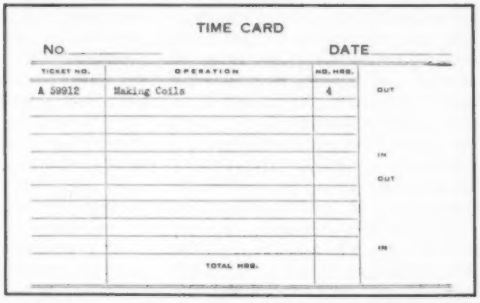

WINDING DATA

Date | Stripped by

	STATOR	ROTOR	FIELD	ARMATURE (Check Which)	TRANSFORMER
Make			H. P.	K. W.	K. V. A.	Job No. A 59912
Type			Speed			Serial No.
Phase			Volts			Model No.
Size			Amperes			Style No.
Form			Cycles			Frame No.
Poles			Slots			Core
Slots			Diameter			Iron (Width)
Coils			Grouping			Span
Turns (Pri.)			Wire			Turns (Sec.)
Connection			Turns (Shunt)			Turns (Ser.)
Loop			Slot Length			Spread
Cause of Break-Down						

NOTE: Make two copies. Original must go to the office.

FIG. 3—*Winding data sheet kept for every motor coming into the shop for repair also carries original job number.*


TIME CARD

NO. | DATE

TICKET NO.	OPERATION	NO. HRS.	
A 59912	Making Coils	4	OUT
			IN
			OUT
			IN
	TOTAL HRS.		

FIG. 5—*Time card carries job number of repair jobs assigned to mechanic.*

READY NOW

"PLUG-IN" STRIP WITH GROUNDING FACILITIES

TYPE CF2-G

"Plug-In" Strip provides convenience in location through a s-p-r-e-a-d of outlets. Outlets every 6" or 18".

A dual-purpose, metal-clad, multi-outlet assembly—two electrical wiring systems in one.

Dual Service Receptacle (Insulator barriers removed for illustration)

Type CF2-G Grounding "Plug-In" Strip permits use of grounded or ungrounded devices *from the same outlet* . . . Will take either the new *Series 5200* 3-blade grounding plug or the standard 2-blade ungrounded plug.

STEEL FOR PERMANENCE
GROUNDED FOR SAFETY

Listed by Underwriters' Laboratories, Inc.

UNLIMITED APPLICATIONS . . . in FACTORIES . . . OFFICES . . . STORES . . . HOMES . . . HOTELS . . . APARTMENTS . . . SCHOOLS . . . HOSPITALS . . . INSTITUTIONS . . . "Plug-In" Strip is a professional material. Consult your electrical contractor for installation. *Grounding* "Plug-In" Strip meets contemplated revisions in the National Electrical Code covering grounded electrical systems. Type CF2-G Grounding "Plug-In" Strip is the quickest and easiest method of meeting grounding requirements. Write for our *free* folder "Grounding Plug-In Strip."

Everything in wiring points to NE

National Electric

PRODUCTS CORPORATION

1301 CHAMBER OF COMMERCE BUILDING, PITTSBURGH 19, PENNSYLVANIA

now ALL GUTH for 4-foot

✚ *LIGHT AT THE FLICK OF THE SWITCH*

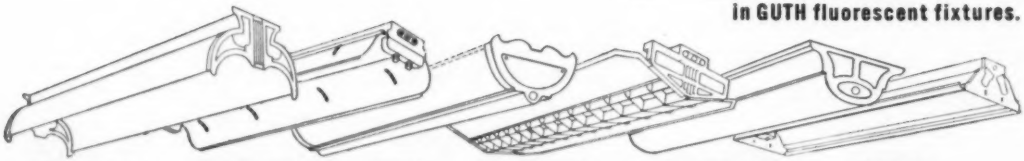
✚ *NO STARTERS*

Here's the biggest fluorescent news in years: you can now use the new 4-ft., 425 ma. T-12 Slimline Lamps in every fixture of the entire GUTH fluorescent line. And the 4-ft. Slimline is efficient! Same lumen output per foot as the 8-ft. Slimline.

Now you have your choice:

- the 4-ft. Slimline
- the 8-ft. Slimline
- standard 40-W lamps
- standard 85-W lamps

in GUTH fluorescent fixtures.



FUTURLITER* MAZELITE* CADET* ARISTOLITE* FLU-O-INDIRECT* TROFFERS

FIXTURES

SLIMLINE LAMPS

✚ EASY TO HANDLE

For full details, call your nearest GUTH resident engineer or write

YOUR TEAMMATE IN *precision-planned* LIGHTING

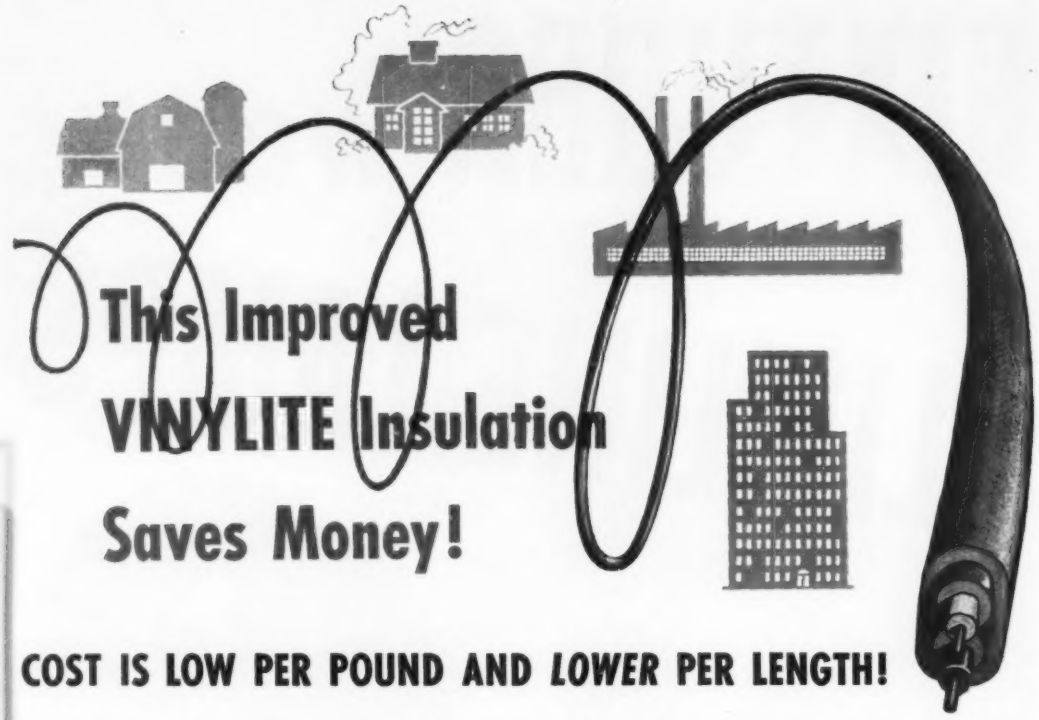
Guth LIGHTING

TRUCOLITE *

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting since 1902

143



This Improved VINYLITE Insulation Saves Money!

COST IS LOW PER POUND AND *LOWER* PER LENGTH!

Even better in performance—and lighter in weight—than comparable insulation materials is a recently developed VINYLITE Plastic insulation for general-purpose building wire.

Because this VINYLITE Plastic insulation weighs less than others—each pound goes further, cuts cost of the improved wire.

Electrical and physical properties given to wire by this new insulation are excellent—rated by Underwriters' Laboratories as suitable for Types T and TW, and for exposure to oil up to 140 deg. F. (60 deg. C.).

Other important qualities are low-temperature flexibility, resistance to high-temperature deformation, water and oil resistance, in addition to the other VINYLITE Plastic insulation advantages of long life, easy pulling, small diameter, and permanent colors.

Some outstandingly successful uses of wire insulated with the improved VINYLITE Plastic include general-purpose building wire, as well as insulation and jacketing of fire alarm and telephone systems. For full information, or names of manufacturers, write Dept. HK-41, today.

Visit the National Plastic Exposition, Navy Pier, Chicago, March 28-31

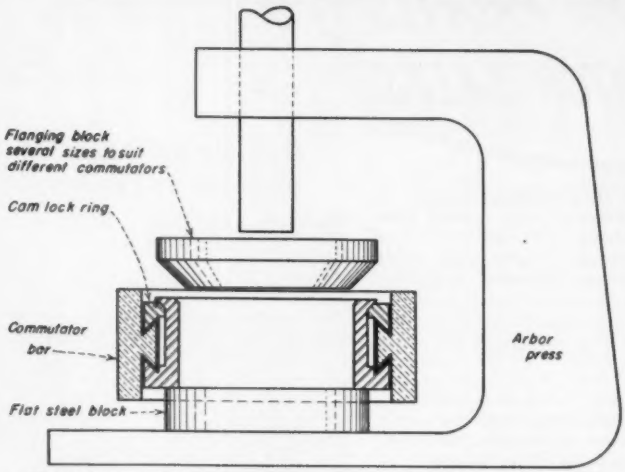
Vinylite BRAND **PLASTICS**

BAKELITE DIVISION

UCC

BAKELITE DIVISION, *Union Carbide and Carbon Corporation* • 30 East 42nd Street, New York 17, N.Y.

Motor Shops



SECTIONAL VIEW *of commutator repair showing use of flanged and flat blocks in arbor press operation.*

Reflanging Commutators

When an armature burns out, the heat generated causes the commutator to expand and slightly compress the insulation between each bar. After the commutator cools, the bars are frequently so loose they can almost be picked out by hand. Normally, this makes the commutator useless and a new one is installed.

However, if the damage is not too extensive the old commutator can be reflanged and tightened so that, when machined and tested, it is as good as new. Cleveland W. Sampson of the Stultz Electric Works, Westbrook, Maine does this rehabilitation work in an arbor press. To assure a tight fit on press type horizontal mica insulated commutators, Sampson uses a set of flanged and flat steel blocks. The commutator rests on the flat block. The flanged block is placed between the commutator and arbor press ram. Several sizes of blocks are made and stocked to fit various sized commutators.

Sampson reports a saving of several dollars on each commutator depending on size. Time required to do the job varies from one half hour to one hour.

This item was entered in the 1948 NISA Awards Contest and is released for publication through the courtesy of the 1948 NISA Awards Contest Committee.

Parts Jar Rack Over Assembly Bench

High level illumination and an easily accessible parts storage system contribute much to small motor assembly efficiency at the Dowzer Electric Machinery Works, Inc., repair shop in Mt. Vernon, Illinois. Both are provided by a combination rack that supports a four-lamp, slimline industrial fluorescent fixture and a total of 96 parts jars above the assembly bench.

End frames of the rack are constructed of 1-inch angle-iron; shaped like an inverted, expanded "U"; are suspended from the ceiling by ½-inch conduit "rods"; support the fluorescent fixture and six 8-foot lengths of 1-in. by 4-in. wood board to which the jar caps are fastened.

Three wood "shelves" are mounted in tiers (to the wings of the rack) over each edge of the bench. Each tier supports 16 glass quart jars containing spare parts. The top row on each side extends 8-inches beyond the edge of the bench; the center row is directly over the edge; the inner row is 7-inches inside the edge. Bottoms of the jars in each of the three tiers are respectively 31-inches, 34-inches and 40-inches above the bench top. The bottom of the lighting fixture is 37½-inches above the bench.

Contained in the jars are such popular fractional-horsepower motor parts as starting switches, throw-out switches of all types, governors, bearings, thermal overload relays and numerous other small motor accessories. Color-coded labels on the jars indicate if the part is included in the reconditioning price (not to be listed on work order for separate pricing) or if the mechanic should add it to his work

PARTS RACK *with built-in fluorescent fixture over assembly bench at Dowzer Electric Machinery Works, Inc., Mt. Vernon, Illinois. Unit speeds assembly work by keeping all parts visible and accessible and by providing good illumination on bench top.*

CONTRACTORS:

MAKE EASY EXTRA PROFITS FROM TIMESWITCH SALES

GENERAL ELECTRIC TIME SWITCHES **are easy to sell as "extra-profit" items along with most of your regular jobs. Wherever an electric circuit needs to be turned on and off repetitively, there's an opportunity for you to make a sale. Customers appreciate the convenience, economy, and safety of G-E time switch control.**

HAVE YOU CONSIDERED THESE POSSIBILITIES—AND POINTED THEM OUT TO YOUR CUSTOMERS?

G-E Time Switches for . . .

Store window lighting	Apartment hall lighting
Electric sign control	Factory yard lighting
Refrigeration defrosting	Heater and cooling control
Electric appliance control	Public building lights

Conveyor, fan, solder-pot, or oven control in factories

There's a G-E time switch for each of these jobs, and others that may tie right in with construction you're doing now.

Type T-47 Handy Time Switch is best for single on-off operations. It repeats a cycle (minimum on 5 min., maximum 22 hrs.) every 24 hours. Only $10.98 list.

Type T-27 is the "complete" time switch. It's easily adjusted for any daily schedule, even a constantly changing dawn-dusk arrangement (with astronomic dial). It also can be furnished with an omitting device to make it skip certain days. Prices are from $25.50 list. Both switches have large silver contacts and reliable Telechron® motors.

EASY INSTALLATION— **Roomy wiring space, simple knockouts, and a mechanism that need not be removed from the case helps simplify your installation job.**

Start adding this easy, extra profit to your regular jobs. Get a supply of G-E time switches from your nearest distributor. If you want more details, write for Bulletin GEC-535 (T-27) and GEC-578 (T-47). *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

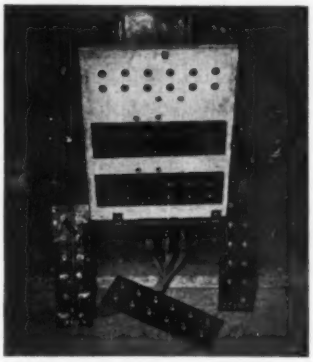
GENERAL ELECTRIC

sheet. Jars are removed and replaced by a simple twist of the hand.

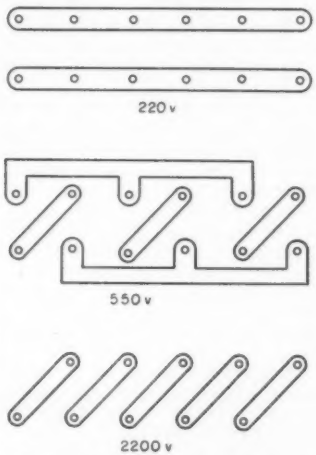
Biggest advantages of this system, as outlined by shop foreman H. Ray Wilson, are: All parts are visible in the glass jars; all are within arms reach of the mechanic; the entire bench top can be devoted to assembly work. Including the fixture as an integral part of the rack provides an unobstructed path of light to the bench top.

Multiple Voltages Obtained by Tap Boards

Three voltages are used for testing purposes in the shop of the J. L. Hemphill Company, North Bergen, N. J., the voltages being 220, 550 and



Pre-wired tap boards are inserted into Transite jack board mounted to generator when voltage changes are required for testing purposes



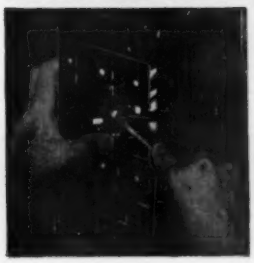
Tapboard bus detail indicates method of wiring for 220-, 550- and 2200-volt connections. Inserting proper board eliminates necessity of tedious rewiring.

Type NMO **MULTI-BREAKER** "Plug-in"

BREAKERPANELS

TRADE MARK

Tailor-made for the job-on the job



1. Select Multi-Breaker units required by job.

2. Assemble units to panel by "plugging in".

3. Wire them.

4. Plug them in place again.

Cutler-Hammer Type NMO Breakerpanels make it easy to "tailor" the circuit requirements of each job . . . either when the panel is first installed . . . or at any time later when the requirements of one or more of the circuits has changed. How is this done? It is very simple!! The Multi-Breaker unit serving each circuit just plugs into place. Where you want a 15 ampere breaker, you plug in a unit containing the exact number of 15 ampere single pole breakers required up to four. These four pole units are available in *17* different circuit combinations making it possible to obtain the exact quantity and rating of branch circuits with a minimum of effort.

Wiring these Type NMO Multi-Breaker units is also a cinch. You can wire them right in your hands before you plug them in . . . or you can simply swing them out for wiring as shown, using one of the positive-pressure contact jaws turning on the silvered bus bar as a hinge. And despite the small size of these Breakerpanels that better utilize wall and column space, you get much more gutter space (5½" in the 15" box) *with* more circuits. The narrow column type actually has *double* the number of circuits previously available in cabinets of similar height.

Cutler-Hammer Type NMO "Plug-In" Breakerpanels are now offered in sizes with from 8 to 42 single pole branch circuits in increments of 2. They are available in 120/240 Volts a.c., with 50, 100 and 200 ampere mains (lugs or circuit breaker) with 15, 20 and 30 ampere single and double-pole branch circuits; also, 40 and 50 ampere double-pole branch circuits each of which however, occupies the same space as four single pole 15 ampere breakers. Multi-Breaker units are of the thermal-magnetic type that provide a lag on harmless overloads but instant trip on shorts.

Beyond any doubt, this is the finest protection, the easiest to install, the most flexible, the most compact, and the most modern it is possible to obtain where a large number of branch circuits must be served, as in commercial and industrial buildings, hotels, schools, hospitals, large homes, etc. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wis.

FULLMAN **Latrobe** PRODUCTS

FLOOR BOXES ★ WIRING SPECIALTIES

INSTALLATION — *Quick!*
SERVICE — *Dependable!*

There's no fuss and delay in installing "Latrobe" Floor Boxes and Wiring Specialties.

"Latrobe" Products are neatly and compactly constructed to make installation easy and assure smooth performance.

No. 252-R Two Gang Box with No. 206-207 Nozzle

The 2-gang adjustable Floor Box is shown with No. 208 Receptacle in one section. One Cover Plate has ½" Flush Brass Plug and one has 2" Flush Brass Plug.

No. 470 "Latrobe" Pipe or Conduit Hanger

Sturdy and dependable for hanging pipe or conduit ½", ¾" and 1" to steel beams up to ⅜" thick. Larger sizes for larger pipe.

No. 280 Nozzle with No. 200 Cover Plate

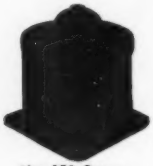
10 Amp. 250 volt Receptacle in Brass Housing, mounted on ½" brass pipe extension 3" long. Longer extension if desired.

No. 110 "Latrobe" Watertight Box

The neat compact design of the No. 110 Box quickens installation time and makes for smooth, trouble-free service. 208 Receptacle. Cover Plate is 3½" diam.

No. 284 Nozzle with No. 200 Cover Plate

Here we have the neatest and most compact Duplex Receptacle Nozzle on the market. Shown with ½" Brass Pipe Extension. Can be furnished also with ¾" pipe extension.



No. 150 Box— No. 207 Nozzle

A compactly built box for installation in concrete or wood finished concrete floors. Adjustable and watertight. 4½" Cover Plate No. 242 and large Adjusting Ring No. 215.

Sold Only Through Wholesalers

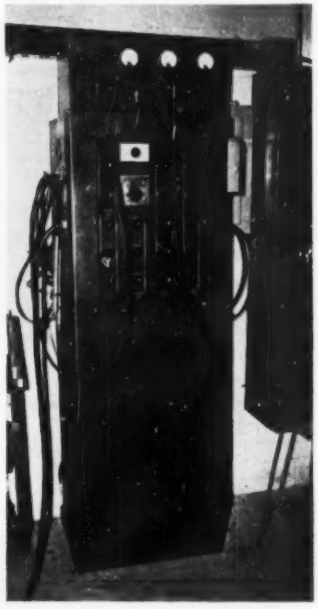
FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

2200. To obtain these various voltages, it was formerly necessary to rewire the generator so that coil end sequences would follow the patterns indicated in the accompanying drawing. This process of reconnection has been eliminated through the use of prewired tap-boards. Coil ends are brought to the back of a Transite jack board and, as different voltages are required, the pre-wired tap-boards are inserted into the jack sleeves. Tap-boards are bakelite, with taps connected by copper straps, and these boards are plainly marked to insure accuracy. When not in use, tap-boards are hung on pegs adjacent to the generator, insuring their convenient location and protection.

Compact Test Board

A. E. Braden, general manager, Electric Motor Service Co., Inc., Jackson, Michigan, has designed and built a test board that occupies only three square feet of floor space in his shop; provides test facilities for the following voltages:

220- and 440-volt, single-, two-, and three-phase
550-volt, single- and three-phase
110-volt, single- and three-phase
500- and 2,000-volt single-phase for hi-pot test



Narrow test board occupies small floor area; provides multiple-phase, multiple-voltage test facilities in Jackson, Michigan motor service shop.

Panel face has stencilled circuit diagram to identify proper jacks for desired test voltage. Hi-pot jacks are controlled by main and selector switches on meter panel. Other switch is multiplier for meter dials.

The jack-plug board is 72-inches high, 24-inches wide and 18-inches deep; has a test panel 25-inches high and 16-inches wide; incorporates a meter enclosure that is 23-inches long, 10-inches high and 10-inches deep. A total of 18 jacks on the test panel provide the multiple-phase voltages listed above. Also included are a 220-volt, 3-phase receptacle and a pilot light for the board. The entire board is supplied by a 220-volt, 3-phase utility service and is controlled, with exception of the high voltage test, by a pushbutton and magnetic contactor.

All test transformers are mounted inside the metal-front enclosure. Indicating meters have their respective instrument transformers in the meter cabinet on the top of the board. The three meters indicate test amperes per phase, either direct (0-30 amps.) or through a multiplier switch (multiplier of 7). Transformer leads are connected direct to panel jacks; plug circuits go through the meter transformers to the test leads. The three toggle switches on meter cabinet (see photo) are scale multiplier (right); hi-pot transformer (center) with pilot light and hi-pot voltage selector (left).

A one-line circuit diagram with proper phase and voltage designations is stencilled on the test panel so the mechanic can quickly visualize and choose the proper jacks for the desired test voltage.

WANT MORE INFORMATION ABOUT A NEW PRODUCT?
See Reader Service page 81

Start the NEW Year Right with Signal

NEW Products ... NEW Profits

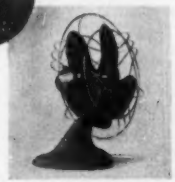
NEW Signal Electrically Reversible WINDOW FANS

WR-162 Electrically Reversible Window Fan—WR-162 Electrically Reversible Window Fan—50-60 cycle, 16" blade, 2 speeds each way, switch on panel, delivers 1500 C.F.M. in both directions. Illustrated is a typically handsome bedroom

FEATURES ● Capacitor type reversible motor (on models WR-122 and WR-162 only). ● Sliding telescopic panels fit variety of window sizes—wing nuts provide finger-tip adjustment. ● Ideal for night cooling—no wiring or carpenter work required—just plug in. ● Neutral ivory, baked enamel finish harmonizes with home furnishings. ● Closely spaced wire safety guard. ● Quiet operation—rubber mounted motor. ● Five Models—WR-122—12" Reversible. WR-162—16" Reversible W-101—10" Non-reversible. W-121—12" Non-reversible. W-201—20" Non-reversible.

NEW COOL SPOT DESK FANS

Model 1049—50-60 cycle, 10" oscillator, 1-speed, delivers 600 C.F.M., light tan finish.



Model 1249—50-60 cycle, 12" oscillator, 2-speed, delivers 800 C.F.M., opalescent Windsor green finish.

Model 1649—50-60 cycle, 16" oscillator, 3-speed, delivers 1250 C.F.M., beautiful opalescent Windsor green finish.

FEATURES ● 7 models—10", 12" and 16" blades, deliver 600 to 1500 C.F.M. ● Oscillating unit adjustable for oscillating or non-oscillating operation. ● Vibration free—quiet type blades. ● Oilless type, porous bronze composition bearings. ● Handsome neutral finishes blend with office and home furnishings. ● All fans available in special voltages; add 10% to list price.

DESIGNED RIGHT! Signal and Cool Spot fans have genuine customer appeal.
BUILT RIGHT! Signal and Cool Spot fans are built to sell and stay sold.
PRICED RIGHT! Signal and Cool Spot assure quick turnover — handsome profits.

TODAY, write for full details and attractive discount schedule on the complete *Signal* line!
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Signal Electric Mfg. Company, Menominee 4, Michigan
Window Fans ● Desk Fans ● Pedestal Fans ● Kitchen Vent Fans ● Exhaust Fans ● Vent Fans ● Drills ● Grinders ● Drill Stands ● Floor Fans ● Automatic Shutters

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Whenever you need a helping hand, call your Central Conduit Distributor. You'll like all the products he has for sale and his way of doing business.

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CENLACO a hot dipped galvanized and lacquered finish, inside and out.

CENTRAL WHITE electro-galvanized outside and black enameled inside.

CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.

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Division of The National Supply Company
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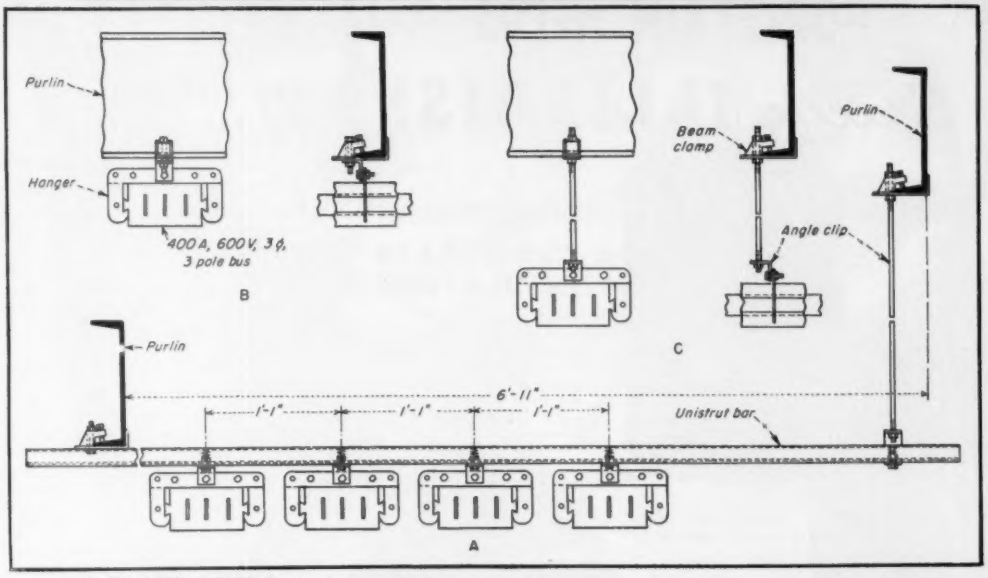
Practical Methods



BUS HANGER DETAILS ***showing application of Unistrut trapeze bar (A) for parallel duct runs; beam clamp mounting on low purlins (B) and rod suspension from high purlins (C) of single-duct lateral runs.***

Unistrut Supports Bus Duct System

WIRING

When Ralph H. Decker, consulting electrical engineer of Chicago, designed the electrical system for a Chicago area industrial plant, he specified a complete, flexible bus duct distribution for power circuits. Four main feeder ducts parallel the length of the plant area and branch off its eight lateral plug-in runs along the way.

Where circuits were at right angles to roof purlins, duct was suspended direct from the steel; where parallel to purlins, trapeze hangers were used. In all cases, Unistrut beam clamp assemblies were specified.

The four-circuit main duct run was between and parallel to two steel roof purlins at different elevations. To keep the four ducts level and facilitate alignment, Decker designed a Unistrut trapeze (P1000 and P2000 for two-duct run) that was clamped direct to the lower purlin and suspended by rod from the upper purlin. Ducts were suspended by angle clips and duct hangers from the bottom of the bar channel.

Single-duct laterals were mounted with similar beam clamp assemblies direct to the low purlins and by rod suspension from the higher purlins. Punching and drilling of structural steel and hanger assemblies were entirely eliminated. All hangers were pre-assembled before installation. Long threads on the suspension rods facilitated leveling of the duct runs and the Unistrut trapeze bar simplified alignment of the feeder ducts. Net result: A well engineered installation combined with substantial man-hour economies. Installation was made by Bowers & Clark, Chicago electrical contractors.

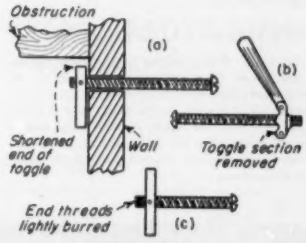
Hints For Using Toggle Bolts

WIRING

When using toggle bolts, several practical hints may be followed that will add to the versatility of these useful devices. One such hint is to shorten one or both ends of the toggle with a hacksaw when space limitations prevent the use of the toggle in its original, full-dimensioned condition. In this manner, toggles may be used in confined positions and through walls where hidden obstructions are near the drilled hole.

A second hint is to remove one complete section of a spring type head when conditions similar to those just described exist and when the complete bolt cannot be used as intended.

To prevent the head from backing off from the bolt after it has been inserted, it is well to slightly burr the end threads of the bolt with a pair of cutting pliers. And, when normal friction is insufficient to hold the wings of the toggle while the bolt is rotated,



TOGGLE BOLTS ***can be used in confined locations by shortening the toggle sections (a) or removing a section of a spring type head (b). Losing the head is prevented by lightly burring end threads of bolt (c).***

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GUY STRAIN INSULATORS

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HIGH MECHANICAL STRENGTH
EXACT DIMENSIONS
COMPLETE UNIFORMITY

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• MACOMB, ILLINOIS •

additional holding friction can be created by backing the wing against the burred threads before it is inserted in the wall.

These helpful hints are experience-tested by Thomas Trail of Baltimore, Maryland.

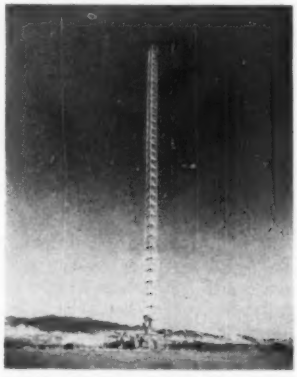
New Technique For Tall Towers

DESIGN

A new technique in tower design and construction, which should be of tremendous commercial and industrial interest, has been developed and used by the U. S. Army Signal Corps. Required for radio test work on military projects, towers over 200 feet high have been designed which can be erected by a crew of six men in six hours, and dismantled in three hours.

This new type tower, made of aluminum alloy tubing, provides an entirely new conception of getting up into the air quickly and easily. The towers constructed by the Signal Corps were 204 feet high. They were constructed of 34 six-foot sections (each weighing less than 100 lbs.), hoisted into position by a davit assembly moved successively from one section to the other. No nuts, bolts or tools of any kind are required in the erection of these towers which were manufactured and supplied by Up-Right Scaffolds, Berkeley, California. Each tower section is complete with stairway, platform, diagonal bracing and guard rails. Each section locks into the other to provide a unitized structure.

Guy wires suitably anchored to the ground were used to support the Sig-



RADIO TOWER *of aluminum alloy tubing is 204 feet high, can be erected by six-man crew in six hours, dismantled in three. Used by U. S. Army Signal Corps, it offers many commercial possibilities where tall towers are required.*

When you check over the many features and advantages of Hazakrome thermoplastic insulated small diameter building wire, you'll see why this Hazard product simplifies many otherwise tough jobs and, just as important, assures long-lasting, trouble-free circuits.

HAZAKROME simplifies planning and estimating because all of these features are obtained with just one wire:

- Oil resistance
- Moisture resistance
- Chemical resistance
- Non-flammability
- Ozone resistance
- High dielectric strength
- Operating temperature 60C.
- High current-carrying capacity combined with smaller diameter

Installation is easier because HAZAKROME:

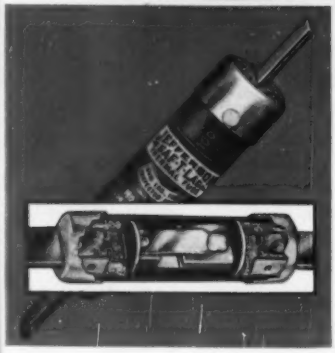
- *has lubricated, smooth surface* for quick, simple, easy pulling without jamming or damaging insulation;
- *is free stripping* which speeds terminating;
- *is tough and resilient*—2000 lbs. per sq. inch tensile strength;
- *requires less conduit space;*
- *is NEC approved* for both raceway and open wiring.

Hazakrome Building Wire is available in a full range of sizes and non-fading colors. Ask your Hazard representative for full information about this problem-solving building wire or write Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

7884

HAZARD

CUT Idle Time COSTS



JEFFERSON
SAF-T-LAG
Thermal
FUSE

JEFFERSON ELECTRIC

Plant costs go on whether machinery is idle or operating. Needless motor stops and expenses can be avoided by using fuses which protect TIME as well as motors.

In Jefferson Saf-T-Lag Thermal Fuses a leaf type trigger spring is rigidly connected to one of the two solid copper elements while the other end, under tension in an upward direction, is held to the opposite copper element by means of solder having a melting point of 280° F.

Since the heat is absorbed until reaching the melting point of the thermal solder connection, which involves a longer heating interval, the result is a time-lag four to five times longer than usual.

On heavy overloads and on short circuits, the notched thin end fuse elements provide immediate protection by blowing in less than 1/10 of a second—before the thermal solder can melt.

JEFFERSON ELECTRIC COMPANY
BELLWOOD, ILLINOIS

nal Corps towers. Outboard platforms can be installed at any required level to provide additional platform area.

Predecessor of the 204-foot towers was a similar 100-foot unit set up by the Army Signal Corps at their Research Laboratory in Redbank, New Jersey. Experimental construction and use of the 100-foot tower was so successful that it led to the adoption of the taller towers when the need for such towers arose, plus the fact that the towers can be set up in record time at any location, and can later be dismantled, packed and shipped to a new location.

This new technique in tower construction and application is unique in the advantages it offers where portability, ease of erection, speed of erection, and easy and safe access to the top of the tower is desired. A man ascending or descending walks up and down a series of stairways completely surrounded by the structure, and with all the ease of walking up or down a stairway in his own home. It offers a broad field of application by television companies, construction companies, municipalities for installing floodlights for special affairs, and for other similar uses where getting up into the air safely is considered a problem.

Flexible Wiring Aids Display Lighting

WIRING

An ingenious adaptation of Bulldog Universal Trol-E-Duct has been made in the recent installation for window lighting at Hearn's Department Store, New York. Designed by General Lighting Co., Inc., New York City, manufacturers of architectural lighting equipment, this new use of Trol-E-

BRACKET FIXTURES ***for R-type lamps have universal swivel, support color filters and shields independent of lamp, attach directly to Trol-E-Duct, and are made by General Lighting Co., Inc., New York City.***

TROL-E-DUCT *wiring in show windows of Hearn's Department Store, New York City, provides ample outlets where needed for flood and spotlights used for display lighting.*

Duct permits the utmost in wiring flexibility and portability of lighting equipment.

Used almost exclusively in commercial and factory installations in the past to allow as much flexibility as possible for power tools and assembly line technique, it has now been found that Trol-E-Duct really fills the vital need for speedy changes of lighting units for store and display illumination requirements. It will be a welcomed aid to display managers, window display sections and department heads, who in the past have been limited in their work by existing fixed and inadequate outlets for their light sources.

At Hearn's, with this new installation of Trol-E-Duct, when display needs call for the addition of more fixtures or the rearrangement of individual units, they can be snapped on by a layman at any point in the duct without any new electrical work. Flood or spot lights can also be added whenever required and all units can be beamed in any direction needed. If necessary, the entire system can be altered for changed conditions, all with a minimum of labor and cost. Rearranging displays is no longer a problem, for the store display man has adequate outlets wherever needed, and additional units may be installed at will.

In the installation at Hearn's, an adjustable bracket type fixture was used which accommodates the R-30 lamp, the PAR-type lamps, or any R-40 lamp up to 500 watts, all in conjunction with a color filter. These units are designed so that the color filters and shields are supported by the bracket, leaving the lamp free from undue strain and giving it longer life.

ACCURATE PIPE CUTS
Quick and Easy

RIDGID Cutters roll right through all kinds of pipe and conduit

● It's really a cinch to cut pipe extra fast with the popular efficiency-balanced RIDGID cutter. Thin heat-treated tool-steel blade leaves practically no burr. Every cutter factory-tested to make sure it tracks perfectly. Your choice of five sizes to 6" pipe; four-wheel cutters to 4." Choose the favorite of men who know fine tools—buy RIDGID cutters at your Supply House.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL CO. • ELYRIA, OHIO

You know
You're right
with "G-E White"

When wiring needs protection, it pays to give it the best protection you can buy.

That means the kind of protection your wiring gets with General Electric white rigid conduit. Inside and outside—*G-E White* gives two protective finishes—hot-dipped zinc and glassy-smooth, Glyptal enamel. Protection like this makes *G-E White* your best buy when you're looking for extra-long service life.

The smooth finish on *G-E White* actually speeds installation by making wire pulling easy and fast. For speedy installation and long service it pays to specify General Electric white rigid conduit.

Double protection . . . inside and out

For information on conduit, see your General Electric Construction Materials distributor, or write to Section C2-218, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

**Trade-Mark Reg. U. S. Pat. Off.*

G-E Black Rigid Conduit

On jobs where economy is a factor—and corrosive conditions do not require the *extra* protection of *G-E White*—remember to specify *G-E Black*.

GENERAL ELECTRIC

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Save time, trouble and money. We will tell each manufacturer to send you the information you want. Instead of writing many letters to get the material you need, just fill in this easy-to-use postcard and we will do the rest. For years we have been rendering this service on catalogs and bulletins . . . now we expand this service to include every department. It's free . . . It's as useful as you make it.

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Electrical Construction and Maintenance is written for you by a large staff of editors and consultants, each an authority on some phase of the business. They will be glad to give you expert advice and answers to your questions.

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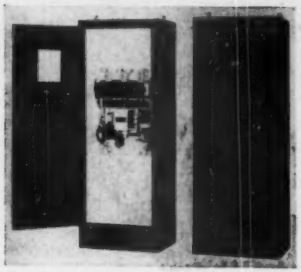
Product News



Solenoid Starters (1)

The standard line of Bulletin 709 ac, across-the-line solenoid starters now includes two new larger units. Size 6 has ratings of 600 amp, 200 hp, 220 v; 400 hp, 440-550 v; and Size 7,900 amp, 300 hp, 220 v; 600 hp, 440-550 v. Both units have one-piece magnetic plunger which operates with a vertical straight line motion. The solenoids are energized with dc drawn from a self-contained selenium rectifier. Both starters have adjustable thermal overload relays. All terminals and wiring are accessible from the front.

Allen-Bradley Co., 1305 S. First St., Milwaukee 4, Wis.

Tester (2)

A tester for fluorescent fixtures has been developed. Known as Flur-Test, it gives quick, positive check of tube, starter and fixture circuit when lamp fails to light. Testing operation is simple. With lamp in normal position the tester is inserted in place of the starter. If fixture circuit is good, the Flur-Test will light. To check tube and starter, the button at the top of the Flur-Test is depressed until end of tube glows; button is then released; if tube lights, starter is defective. If tube fails to light, tube needs replacement. Two models are available—No. 321 for 15 to 40 watt lamps and No. 322 for 85-100 watt lamps. Adapters are made for tester to be used on lamps where starter is concealed behind the tube.

Continental Electric Equipment Co., Box 1055, Cincinnati, Ohio.

Connector and Coupling (3)

New 1 inch EMT thinwall connector and coupling, Nos. 12 and 312 respectively, have been added to this line of fittings. The No. 12 connector embodies the same features found in all Tomic connectors. Interior stainless steel lock washer holds tubing securely. No. 312 coupling also has the same design as other Tomic couplings. It enables one to change from heavy pipe to thinwall and vice versa in the middle of a job. It can also be used to go from thinwall to Greenfields, and from thinwall to BX, Romex, rubber cords or welding cables, etc. They carry Underwriters' approval.

Tomic Sales & Engineering Co., 4864 Woodward Ave., Detroit 1, Mich.

Ground Detector (4)

This new ground detector apparatus permits detection and location of ground faults on isolated (ungrounded) electrical distribution systems while all circuits are "hot" and equipment is operating. It consists of a signal generator and hand receiver instrument. Generator superimposes a signal current on the grounded phase conductor. Signal current (up to 22 amp maximum) flows through conductor to point of ground fault, then back to generator through ground path. Fault is located by passing signal receiver along feeders, distribution cabinets and branch circuits to equipment. Microammeter in receiver picks up signal current and gives pulsating indication until point of ground fault is reached where needle remains stationary.

Ferr Manufacturing Co., Inc., 2125 South Western Ave., Chicago 8, Ill.

Insulation Tester (5)

The hand-cranked "Meg" type of "Megger" is now available in a combination hand-crank and rectifier-operated set. It consists of the "Meg" type constant-pressure test set and a separate rectifier which supplies 500 volts dc from any 115 volts ac, 60 cycles outlet. One cord from the hand-crank instrument and another from the rectifier to an ac outlet eliminates hand operation. This new dual-operated instrument will have its most important application in communications and in extensive cable wiring and control installations where many tests are to be made, and where an ac outlet is available.

James G. Biddle Co., 1316 Arch Street, Philadelphia 7, Pa.

(6)

***HYDRAULIC TELESCOPIC TRUCK TOWER** feature an outer structural element consisting of 3 or 4 telescopic sections, which takes all eccentric loading, and an inner hydraulic element. Raised height, 26 ft. 8 in., lowered height 8 ft. 5 in. Platform is 4 ft. by 9 ft. and rotates 360°. Construction is of steel, excepting platform floor, railing and insulation. Manufactured by Silent Hoist & Crane Co., Inc., 841-63rd Street, Brooklyn 20, N. Y.*

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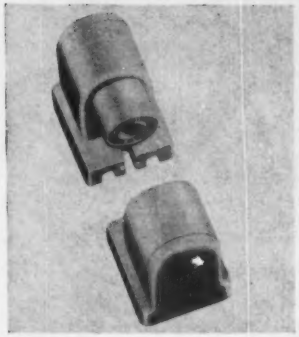
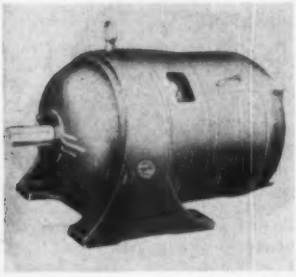


Lampholder (7)

A new fixture-type slimline lampholder that accommodates all T-6, T-8 and T-12 slimline lamps has been announced. They are white plastic, small and compact in design. Measurements from lamp center to top of mounting surface and from lamp center to bottom of base are the same as those found on the conventional bi-pin fixture-type lampholder. They may be mounted 96 inches apart—plus or minus $\frac{1}{8}$ inch, and may be spaced so that center of one lamp to center of adjoining lamp is slightly less than $1\frac{1}{2}$ inches. Small over-all width of device allows mounting in narrow channels.

General Electric Company, Bridgeport 2, Conn.



Gearmotors (8)

A new line of gearmotors, manufactured in 17 sizes, has been announced. They provide single, double and triple reduction units having output speeds from 780 rpm down to 7.5 rpm. Integral horsepower ratings from 1 through 75 hp are available for practically any industrial application. A wide selection of motor enclosures is offered, including the open drip-proof, splashproof, totally enclosed and explosion-proof construction.

Louis Allis Company, 427 E. Stewart St., Milwaukee 7, Wis.

Relay (9)

Type ASL Class "B" insulated, air-cooled transformers can now be supplied with a relay for turning on cooling fans and operating alarms as transformer loads increase beyond normal self-cooled ratings. Type TRA relay makes possible loading air-cooled transformers automatically to maximum safe copper temperatures. A selector switch on the relay provides either automatic operations using the relay or manual control. Operation of relay is coordinated with the hot-spot temperature of the transformer windings. A 60 cycle, 240 volt power source is required for operation of the relay. This can be either the source for the fans or a separate power supply.

Westinghouse Electric Corporation, P. O. Box 2099, Pittsburgh 30, Pa.

Load Centers (10)

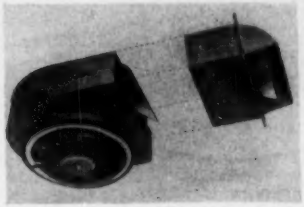
New "plug-in" type multi-breaker load centers for lighting and appliance circuits have been announced. The "plug-in" feature makes it possible to add or change circuits as conditions require. Use of load centers minimizes wiring and installation time and eliminates excessive stocks and bookkeeping records. Type MO 12 gives 2, 4, 6, 8, 10 or 12 circuits, as required, when thermal-magnetic multi-breaker units are plugged on to the basic bus bar structure. Basic unit consists of a box with bus structure and one 4-circuit "plug-in" unit in place. Units are available in ratings of 15, 20, 30, 40 and 50 amp, 120/240 volts, ac. Type MO 20 is similar to type MO 12. It has space for as many as 2 or 4 circuit units, giving 6, 8, 10, 12, 14, 16, 18 or 20 circuits as required. Load centers are available with flush or surface type mounting covers and 3 phase 4 wire arrangement.

Square D Company, 6060 Rivard Street, Detroit 11, Mich.

Circuit Breaker Panel (11)

A new flexible circuit breaker has been introduced. Known as Noark QL panelette, it employs Quicklag circuit breakers in a calibrated range of 15, 20, 30, 40 and 50 amp, and cabinets with 2, 4, 8, 16 or 20-circuit breaker capacity. Double pole operation is obtained by adding handle extensions. Breakers employ a thermal-magnetic trip action. An electromagnet breaks the circuit instantly when its current setting is exceeded. A bimetal flexes and trips the breaker as soon as its own predetermined current setting is reached or passed.

Federal Electric Products Company, 50 Paris Street, Newark 5, N. J.



Kitchen Ventilator (12)

A new 10 inch ventilator, designed primarily for kitchen use, has been developed. It can be ceiling or inside wall mounted. Ventilator can be installed for either single or three speed operation. It changes the air of the average kitchen in three minutes. Fan unit is equipped with a four pole motor driving the new Turbo-Radial propellor. Balanced louvre in blade housing is protection against drafts or cold. Outside wall hood, made from aluminum, rust proof, and fitted with water tight louvre door. Overhanging hood prevents entrance of rain, snow, cold, insects and birds. Can be wired to any standard single throw switch plate for single speed installation. A speed controller can be furnished.

Fasco Industries, Inc., Rochester 2, N. Y.

oil resistance
chemical resistance
high stability
bakes clear through
low cost
Combines all 5

NEW IRVINGTON #1100 CLEAR INSULATING VARNISH

Now—just one varnish is all you need for practically all windings. And just one coating normally is enough, when it's a coating of Clear Irvington #1100.

This new insulating varnish penetrates to the deepest coil layers, adhering firmly to the wires, and bonding all into a solid mass. The coating produced is tough, oil-proof and lasting. An internal-curing varnish, it hardens clear through after quick baking. The solvent used—V. M. & P. naphtha—will not attack magnet wire coatings. Both shelf stability and dip tank stability are good.

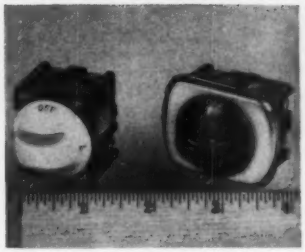
Irvington #1100 is the latest product of Irvington laboratories. It was developed after extensive research to provide a single varnish for use on all windings except those operating at highest peripheral speeds . . . a top-quality varnish at a moderate price.

Standardize on Irvington #1100 and you'll cut your varnish inventory and costs. Samples on request.

Specifications:

Dry Dielectric	2000 VPM
Moisture Resistance	Good
Oil Resistance	Excellent
Acid Resistance	Excellent
Alkali Resistance	Good
Heat Resistance	Very Good
Penetration	Excellent
Baume	25° @ 30 deg. C.
Sp. Gr.	0.903 @ 30 deg. C.
Sp. Gr. for use	Optional
Solvent	V. M. & P. Naphtha

IRVINGTON VARNISH & INSULATOR CO.
Irvington 11, New Jersey



Rotary Switches (13)

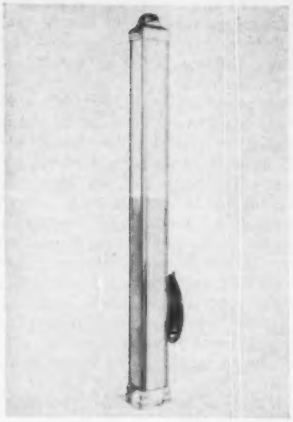
A new series of small rotary switches, designed for a wide variety of applications such as hot plates, rangettes, coffee makers, beauty parlor, air conditioning and ventilating equipment, has been announced. They measure 1½ inches high by 1¼ inches wide by 1 inch deep. Series 240 switches are enclosed with a base of special heat resistant plastic to provide efficient operation with ambient temperatures up to 400° F. They operate on slow-break principle. Available in two models, one for single hole mounting, the other for snap-in mounting. Circuits in which both models are available include series parallel 3 heat 4 position, both single and double pole; on and off, both single and double pole, and off-on (circuit 1) off-on (circuits 1 and 2) double pole. They carry Underwriters' approval.

Hart Manufacturing Company, 110 *Bartholomew Ave., Hartford, Conn.*

Box Cover Switches (14)

A new line of box cover switches available in 3¼ inch and 4 inch types, has been announced. Switch housing and box cover are molded of one piece of bakelite. Cover fits flush on box leaving the entire box free for splices, lock nuts, and bushings. All switches have positive kick-offs, arc-snuffers, pre-loaded contacts. T-rated switches are made of black bakelite, non-T-rated are made of brown bakelite and oil burner switches of red bakelite. Ratings are 10 amp, 125 volt. Terminals ample for No. 12 wire. Handle in protected position, operates horizontally. Approved by Underwriters' Laboratories.

Pass & Seymour, Inc., Syracuse 9, N. Y.



Service Station Light (15)

A new column light for service stations and other applications has been announced. The fluorescent illuminated standard is built on a superstructure of arc welded steel. Bottom half of housing is constructed of 16 gauge sheet steel. Upper half is Skytex glass enclosed, with four 40-watt fluorescent tubes, mounted one behind each glass panel. Two 40-watt E.T.L. approved, power factor corrected, low temperature, instant starting ballasts are used. One of the glass panels is removable to permit replacement of lamps or to clean insides of glass panels. Flood or spot lamps can be attached to crown cap which is provided with ½-inch threaded openings. Bottom panels can be finished in any color to match any general color scheme. Listed by Underwriters' Laboratories, Inc.

Steber Manufacturing Company, Broadview, Ill.

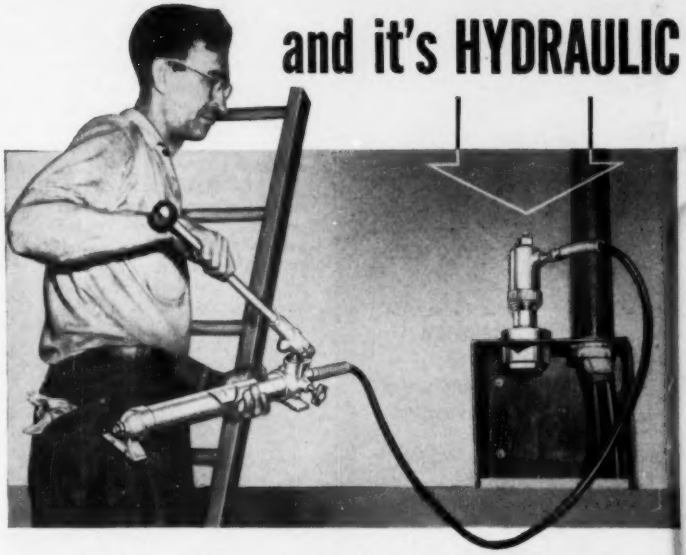
Outlet and Plug (16)

A new-type grounding outlet and plug has been announced. It is for use where NEC or other applicable codes require the grounding of 125 volt, ac single phase, or 115 volt dc powered portable electrical equipment. Both outlet and plug are available in brown or ivory plastic. Outlet has washer-type ears and each pressure terminal holds two No. 12 wires, plus side wiring. Openings in outlet will accept new grounding plugs, standard 2-prong parallel plugs and 2-prong polarized plugs. Two grounding terminals allow easy carry-through of ground wire for nonmetallic systems, conduit systems, BX armored cable, etc. They are approved by Underwriters.

General Electric Company, Bridgeport 2, Conn.

IT'S A KNOCK-OUT PUNCH

and it's HYDRAULIC



No Wrench to Swing! • **Spectacularly Faster**

• **No Box Distortion** • **Close-Quarter Operation** • **Greater Safety**

Now you can punch conduit openings in electrical distribution boxes, pull boxes, etc., with smooth *hydraulic* power! Yes, punch 'em with ease, up to 4½". Eliminate wrench operation and distortion and loosening of boxes. Work in tightest spots. Use the same "Porto-Power" hydraulic pump and fittings which serve Blackhawk Benders. Save at least 60% of the job time! Order from your supply house today!

A KIT FOR EVERY RANGE—
Knock-out punches and the hydraulic ram are available in complete kits serving ½" up to 2" and ½" up to 4½" openings. Hydraulic equipment furnished separately for present owners of hand punches.

ALSO NEW!
Blackhawk's big line now also includes a *Thin-Wall Conduit Bender*. Spectacular speed. Get facts on Rigid-Pipe Benders and all new equipment by writing today for Bulletin B-50.

BLACKHAWK
HYDRAULIC *Porto-Power* EQUIPMENT

BLACKHAWK MFG. CO., Dept. P-2020, Milwaukee 1, Wis.
Without obligation, rush Bulletin B-50 giving full facts on Blackhawk's entire line of Electrician's Equipment.

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CITY.....STATE.....

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TOPS IN QUALITY VALUE LABOR-SAVING FEATURES
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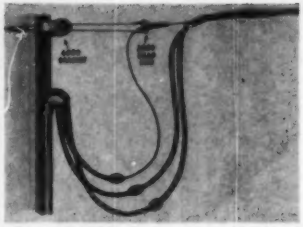
Meet and surpass REA & Federal Specifications

● WRITE FOR CATALOGUE AND LITERATURE!

OVER 100 NEW DEVICES

SLATER
ELECTRIC & MFG. CO., Inc.
WOODSIDE, L. I., N. Y.



Service-Drop (17)

A new service-drop automatic dead end for use with pre-assembled messenger-supported cable, has been announced. Assembled as a one-piece unit, the Series 3800 dead end has one end of the flexible bail detachable for installation around a spool-type insulator or other supporting anchorage. This dead end grips the bare neutral or messenger. The new 4000 Series service drop anchor bracket, for use in anchoring service drops, permits insertion of a closed bail or loop without opening the loop. Both dead end and bracket are designed to harmonize with residential and commercial buildings.

Electroline Company, 4121 South La Salle St., Chicago 9, Ill.

Soldering Gun (18)

A new high speed soldering gun with a single pole electrode, known as the Cal-88, has been announced. The long single pole electrode speeds up servicing by enabling service men to work in narrow spaces between component parts of a set without melting condensers, burning wire insulation, or damaging other parts near the hot electrode. "Full-view" light shines directly on top of electrode and parts being soldered. It weighs 1½ pounds. It has pistol grip with three finger "ease-trigger". Electrodes are corrosion resistant. Gun operates on 60 cycle, 115 volt, ac.

Caliri Manufacturing Company, Inc., 45 Washington St., West Orange, N. J.

Housing (19)

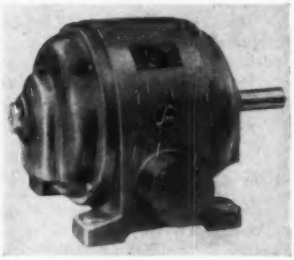
Semiburied housings for standard overhead-type distribution transformers are available. Housings consist of two sections. Transformer rests on two rust-proofed channels supported by a ledge in the lower section. All connections to transformer can be made before the upper section is put into place. Guide rods prevent metal housing from coming in contact with any live parts during lifting. They accommodate transformers up to and including 50 kva. Since they extend only 35 inches above the ground level, they are easily concealed in shrubbery. Ventilation is through space between the concrete section and overhanging upper shell and through openings around top of steel housing. These ventilation openings are provided with baffles to prevent insertion of foreign material into housing. Drainage is provided by a dry well of crushed stone or other material at the bottom of the hole.

Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pa.

Wiring Strap (20)

A new non-corrosive plastic strap for electrical cable of all types has been announced. Especially useful in farm wiring, as required in many REA codes. Two types are available, one with flat opening for double cable, one with round opening for triple wire cable. Non-corrosive copper nails are recommended, and the nail hole, through the thick plastic strap holds nail in upright position.

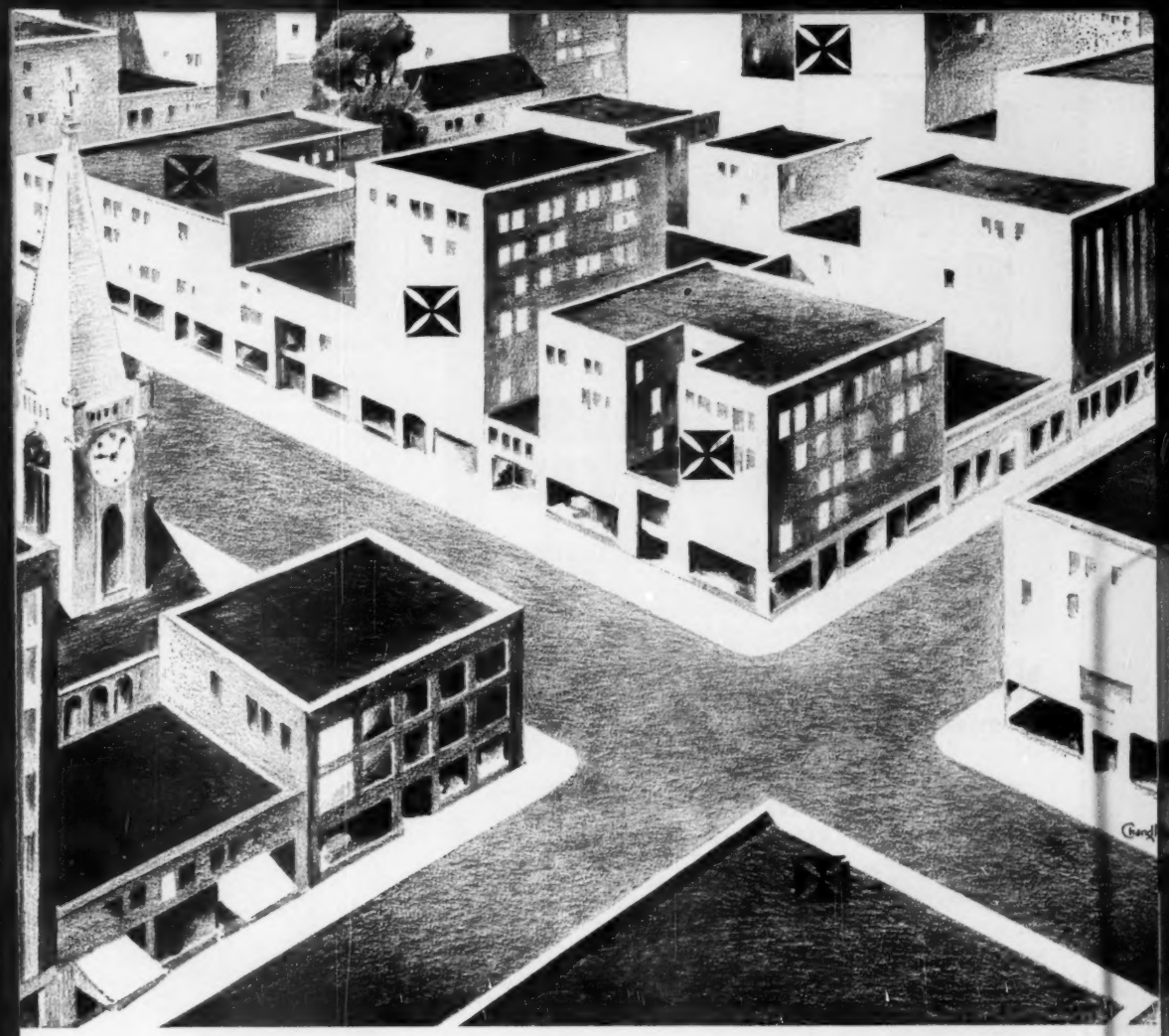
Commercial Plastics Co., Merchandise Mart, Chicago, Ill.



Splash-Proof Motors (21)

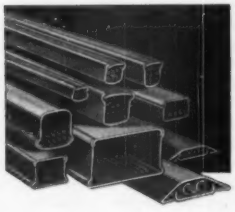
A new design of splash-proof motor has been introduced. It is designed for locations which are subject to direct streams of water or other liquids. Motor may be mounted in any position. End bells permit free passage of ventilating air through integrally-cast baffles, preventing splashing liquids reaching interior of motor. Air is drawn through rear of motor and exhausted through shaft end. Motor incorporates labyrinth seals on shaft ends.

Sterling Electric Motors, Inc., Telegraph Rd. at Atlantic Blvd., Los Angeles 22, Calif.



marks the spot (s) !

It may be a department store, a service station, school, an office, factory, or a restaurant, but chances are it is a good profitable prospect for the alert contractor who works with Wiremold. In every community there are literally hundreds of "spots" where owners or tenants are not enjoying the benefits of *adequate wiring.* The job may involve a simple run of multi-outlets for plug-in convenience of electrical merchandise, an extension of telephone or signal systems, or complex wiring for modern lighting. In every case, Wiremold is the answer. Ten basic interconnecting systems mean you can meet the needs of any application . . . and a small number of carefully designed fittings means a quick, easy installation. Write today for business-building ideas that will help build *your* business.



Know your WIREMOLD

THE WIREMOLD COMPANY
HARTFORD 10, CONN.

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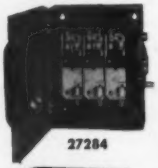
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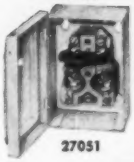
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REDUCE
REPLACEMENT
and REPAIR
COSTS WITH

ARROW AH HART ENCLOSED SWITCHES
AND
SERVICE EQUIPMENT

From the time they are installed, Arrow-Hart enclosed switches stay on the job. Every unit — from small, 30 Ampere "CR" types to heavy-duty, 1200 Ampere "A" types — is designed and manufactured to give years of safe, dependable service. Fewer expensive replacements to be made — fewer costly repairs with Arrow-Hart equipment on duty.

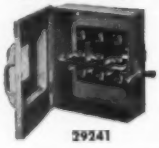
NEW
27196

27367

NEW
SERVICE EQUIPMENT

Shown at left, No. 27196 is the latest addition to Arrow-Hart's complete line of service equipment. This new, compact, main pull-out type — 3 PSN, 30 Amperes, no branch circuits — gives you the same rugged construction, the same safe, dependable operation as do all other lines of Arrow-Hart products.

27162


29241

Investigate this line of dependable performers today! More than 300 cataloged items for your every need. Let Arrow-Hart work with you on your specific problems — help you come up with a time-saving, money-saving answer.

CONTROLS and APPARATUS FOR *Outstanding* PERFORMANCE

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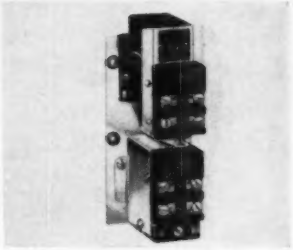
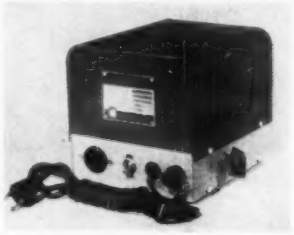


Timing Relay **(22)**

Bulletin 849 pneumatic timing relay has been announced. It is available for ac or dc and utilizes a synthetic rubber bellows for controlling the tripping time. Range is easily adjustable from 10 cycles to 3 minutes, with an accuracy of plus or minus 10%. Relay resets instantaneously. Performance is unaffected by temperature, humidity, or vibration. Timer is available with quick make and quick break, double pole, silver alloy contacts—one set normally open and one set normally closed. Terminals are accessible from the front. A duplicate set of contacts for pilot control can also be provided, actuated directly from the solenoid, and opening and closing instantaneously with the action of the solenoid.

Allen-Bradley Co., 1305 S. First St., Milwaukee, Wis.



Converters **(23)**

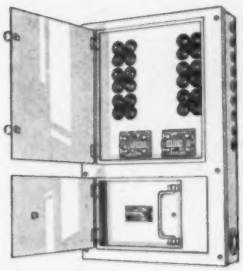
Announcement has been made of the Powercon line of dc to ac converters. All Powercons for dc to ac conversion for use with radio or television equipment are filtered for clear reception, and are capable of starting under full load without necessity of starting converter first and then applying load. Several of the 32 and 110 volt models include the Phantomswitch circuit for automatic starting and stopping when the ac load switch is operated. For conversion from 32 volt dc to 110 volt ac in rural areas, Models 32R8 and 32RU15 furnish capacities of 80 and 150 watts, respectively. Two battery eliminators, creating dc from ac, are available.

Cornell-Dubilier Electric Corp., South Plainfield, N. J.

Boring Trench Machine (24)

A new McCarthy rock and earth boring trench machine has been announced. The machine can be "inched" along at practically zero, or drill as fast as six feet per minute. The drill head rotates from a slow speed of 15 rpm to the higher speeds of 350 and 400 rpm. Four "go" controls and one reverse work from a single position, and only a finger-tip touch is needed to put the machine in operation. It is equipped to handle augers from 4 inch to 16 inch diameter, and drills can be adapted for larger diameters in certain earth formations. Holes have been drilled from 10 to 150 feet horizontally.

Salem Tool Company, South Ellsworth Ave., Salem, Ohio.



Service Equipment (25)

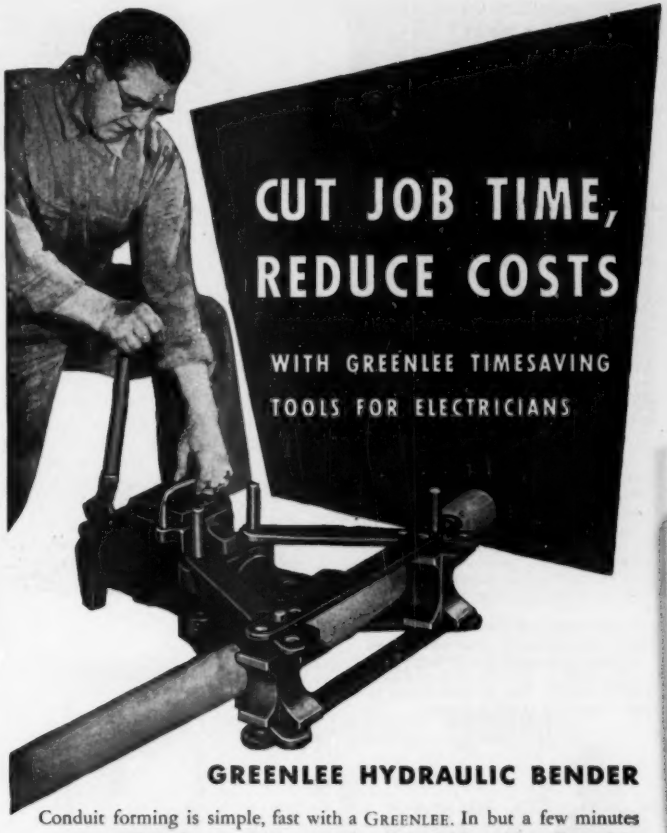
A new 200 ampere, fusible service equipment with range, water heater, lighting and heater circuits, all in one cabinet, has been announced. Door operated types available for surface and flush mounting. Equipment has extra capacity for new or remodeling jobs. Box size is 28½-in. high, 17¾-in. wide, 4¼-in. deep. Rating is 200 ampere, 3-pole, solid neutral, 125-250 volt, ac.

Wadsworth Electric Mfg. Co., Inc., Covington, Ky.

Industrial Fixture (26)

A series of 96 inch slimline industrial fixtures for two or four lamps, and available for 200, 300 or 420 ma lamp operation has been introduced. They are adaptable to individual or continuous row mounting, for chain or stem suspension. Reflectors can be supplied in either baked white or vitreous porcelain enamel and are in two sections. They are attached to top housing by ¼ inch turn cam type captive thumb fasteners.

Keystone Electric Mfg. Co., Inc., 2228 East Tioga St., Philadelphia 34, Pa.



GREENLEE HYDRAULIC BENDER

Conduit forming is simple, fast with a GREENLEE. In but a few minutes *one man* easily makes smooth, *accurate* bends in rigid or *thin-wall* conduit, pipe up to 4½", tubing, bus-bars. No kinking, wrinkling or other damage to conduit. And the GREENLEE is compact, *portable* . . . makes it easy to do bending *right on the job.* Often pays for itself on first few jobs through big savings in time, labor, materials.

KNOCKOUT TOOLS enlarge a hole for conduit or cable in 1½ minutes or less. Cut *smooth* openings up to 3½" in metal, bakelite or hard rubber up to ⅛" thick.

BORING TOOLS that produce smooth openings fast. Electricians' Unispur and Solid-Center Auger Bits . . . Bell Hangers' Drills . . . Bit Extensions.

HAND BENDER quickly makes small-radius bends in steel, copper, brass, and aluminum tubing, conduit or pipe. Makes neat bends up to 180°.

TOOLS FOR CRAFTSMEN
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WRITE GREENLEE TOOL CO., 1742 COLUMBIA AVENUE, ROCKFORD, ILLINOIS for complete data on above equipment as well as GREENLEE Joist Borers • Pipe Pushers • Spiral Screw Drivers • Automatic Push Drills • Chisels, Gouges and many other quality tools.

You waste money when you waste time threading pipe by hand! You *SAVE* money when you thread pipe with the Oster No. 422 POWER VISE STAND.

You can convert your hand die-stocks, cutters, and reamers to POWER with this portable machine.

Standard range of the machine is ⅛" to 2" pipe. Extended range with special, universal drive shaft is 2½" to 8" pipe.

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COMPANY.....

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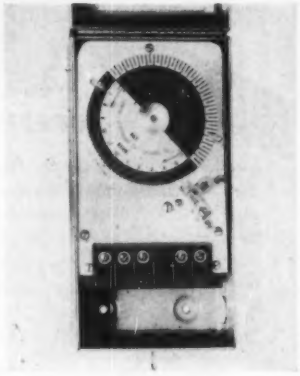
Lighting Standards (27)

A new line of steel lighting standards for city streets and highways has been introduced. These tapered octagon models are offered in a wide variety of styles to meet any requirements. They are built for heavy duty. Standards are cold-formed from open-hearth steel. Designed along modern, practical lines.

Kerrigan Iron Works, Nashville, Tenn.



Time Switch (28)

A new time switch has been announced. It is available for 20 amp loads as standard on 115 v, ac, 60 cycle circuits and 15 amp loads on 230 v. Operation of switching mechanism is all in a forward direction with the movement of standard 24 hour dial. Switch is a 24 hour movement and time operations are adjustable to within 15 minutes. Operation trippers are attached to dial by thumb screws. Other models are SLW with Sunday and holiday cut out and Model W with full week dial with a varied or fixed operation for each day. Operations may be as close as one-half hour apart.

Lumenite Electronic Co., 407 South Dearborn Street, Chicago 5, Ill.

Panelboard (29)

A new Noark Flexunit plug-in distribution panelboard has been announced. It is assembled on-the-job from standard parts. Circuits can be changed or new one added, whenever desired. Other features are—neutral provides for 3 phase 4 wire, and single phase 3 wire services; is available with twin 30, twin 60, 30-60, twin 100 and single 200 ampere switches for 230 volts ac; box and trim are code gauge steel.

Federal Electric Products Company, 50 Paris St., Newark 5, N. J.

Tester (30)

A new pocket size utility tester has been introduced. It is capable of measuring the actual current consumption of any appliance or utility either ac or dc, while unit under test is in operation. Appliance is plugged into front panel receptacle and registers a reading in amperes. A special pair of insulated clip-ends are supplied for motors. Incorporates a sensitive direct-reading resistance range for measuring all resistances commonly used in electrical appliances, motors, etc.

Superior Instruments Co., 227 Fulton St., New York City.

Ceiling Lampholder (31)

A new ceiling lampholder with duplex terminal screws has been developed. Four large screws are employed. Lampholder has built-in sealing-ring shoulders which fit snugly over either a 3½ inch box or a 4 inch box. It is made in two sizes: No. 276, 4¼ inch diameter, and No. 277, 5 inch diameter. Made in special heat-resistant white bakelite.

Slater Electric & Mfg. Co., Inc., 56th Street & 37th Ave., Woodside, N. Y.

module lights a bank

...and demonstrates its remarkable efficiency by maintaining a lighting level of 60 footcandles in the lofty and spacious banking room illustrated. . . .

Mr. Alex Salvatori, President, Peoples Federal Savings and Loan Assn., Wheeling, West Virginia; Director Federal Home Loan Bank (Dist. No. 3) Pittsburgh; past president, West Virginia Savings and Loan League

"we wanted the very latest and finest in everything, including lighting . . .

we chose Mitchell module"

these 4 low-cost modules are the "building blocks" of a perfect custom-fitting lighting installation

D *4 75-Watt T-12 425 Milliamp Slimline Lamps*

C *4 40-Watt T-12 48" Type F Lamps*

B *32-Watt 12" Circline Lamp, and 1 PAR Spot or Flood Lamp*

A *4 14-Watt T-12 15" Type F Lamps*

modules fit together perfectly end to side, end to end, side to side... to form more than 50,000 different lighting patterns...to fit any ceiling shape or size...mixing all light sources in one harmonious system... with equal brightness throughout (no dark sides or ends)...so you can put the light where it is needed!

MITCHELL **module** REG. U. S. PAT. OFFICE

Only *MITCHELL* makes *MODULE*

It takes more than "just another fixture" to sell a bank president! Mr. Alex Salvatori, head of Wheeling's Peoples Federal Savings and Loan Association, says: "When we decided many months ago to buy our new building and go into a complete modernization program, we were sure of one thing—we wanted the very latest and finest in everything, including lighting. We chose Mitchell MODULE, and I am very happy today that we made this decision. The lighting effect in our banking room has brought forth a remarkable amount of favorable comment, and we ourselves are most highly pleased with the job."

Mitchell MODULE delivers *20% more light,* fits *any* architectural interior, provides *custom appearance* in unlimited pattern arrangements—at no more than the cost of ordinary fixtures. For *any* commercial installation—whether it calls for one unit or a hundred—specify MODULE and deliver the greatest development in lighting since the fluorescent lamp. Write today for the full details.

MITCHELL MANUFACTURING COMPANY
2525 N. Clybourn Ave., Chicago 14, Illinois

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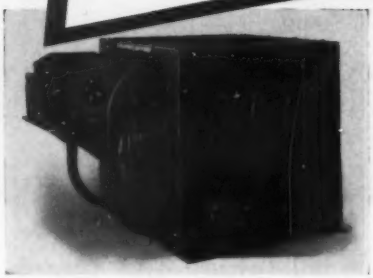
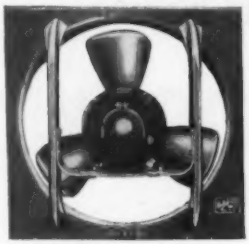
"PACKAGE" FANS

For Simple Installation And Peak Performance



"BUFFALO" "L" BREEZO FAN

"Buffalo" DISK FANS



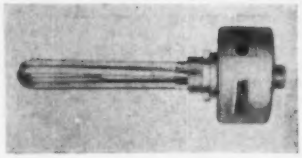
"BUFFALO" BREEZO FAN

- Rugged die-formed blades, motor brackets, arms, panels!
- First grade standard make motors! Dependable, convenient!
- Built in the sizes you need for your jobs!
- Built to deliver efficiently and without trouble — blades shaped to move maximum air!

"Buffalo" "L" Breezo Fans are ideal "package" units for exhausting vapors, fumes and gases. Light, simple to install. Motor protected from air stream. Handy side inspection door. 12" to 36" sizes for as high as 7300 cfm. at ¼" static.

"Buffalo" Breezo Fans are quickly installed in walls where you need to exhaust fumes, heat, dust for health and comfort. 6 sizes, 8" to 24". WRITE FOR BULLETIN 3222-F, for facts on the profitable, top-performance line!

BUFFALO FORGE COMPANY
520 BROADWAY BUFFALO, NEW YORK
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Branch Offices in all Principal Cities



Immersion Heater (32)

A new thermostatically controlled screw-plug immersion heater for heating chemical and oil solutions such as tar, parafin, asphalt, solvents, and other viscous and corrosive liquids, has been announced. One-half inch diameter hairpin tubular elements are welded or silver-soldered into a standard screw-plug for easy mounting in pipes and through walls of tanks. Standard heaters are fabricated of either copper heating elements with a brass screw-plug, or steel elements with a steel screw-plug. Thermostat has a temperature range of 60° to 250° F, for heating water type solutions of 200° to 550° F for oil and other viscous compounds. Heaters are rated from 1.5 to 10 kilowatts for 115 and 230 volt operation, single or 3-phase. For use where spray, fumes, drippings, etc., constitute a hazard, entire terminal assembly and thermostat can be housed in a Crouse-Hinds moisture-resistant or explosion-resistant terminal cover.

Edwin L. Wiegand Company, 7637 Thomas Blvd.,, Pittsburgh 8, Pa.

Polarized Devices (33)

A new line of redesigned polarized devices has been announced. The outlets are available in 10 and 20 amperes, 2, 3 and 4 wire. All receptacles are top wired. The caps are completely armored Bakelite. Also available in 2, 3 and 4 wire, 10 and 20 amperes. Some of the features are cord grips, binding screws, large tapered wireways, cap blades, armored with .016 inch steel.

Pass & Seymour, Inc., Syracuse 9, N. Y.

Lamp Guards (34)

A new safety device that gives protection against the hazard of falling fluorescent lamps in continuous run, end-to-end lighting installations is now available. These fluorescent lamp guards are made of specially treated resilient steel, which makes it possible for them to be sprung aside for relamping and cleaning. They prevent injury, poisoning, work interruption, loss of time, spoilage of material and damage to machinery.

Den-El Equipment Company, 271 Conklin Avenue, Hillside, N. J.

Safety Switch (35)

New 30 ampere front-operated toggle, plug fuse safety switches have been introduced. Available with or without dead front plate, switch has removable laminated arc shields, snap action, full-floating contacts, solderless pressure wire connectors on the line side, and all parts are visible and accessible. Ample wiring is provided and boxes have sufficient knockouts for any wiring requirement. No. 633NP has 3 poles, a solid neutral and 2 plug fuse receptacles. Also available are No. 632P with 2 poles, a solid neutral and 2 plug fuse receptacles and No. 632NP with 2 poles, a solid neutral and 1 plug fuse receptacle.

General Switch Corp., 45 Roebling St., Brooklyn 11, N. Y.

Bell and Buzzer (36)

The "Snapit" melody bell embodies the use of a tonal bar instead of the ordinary clapper and bell. It is housed in an ivory plastic case, 4 inches by 2¼ inches. It can be mounted directly to a "handy box" for concealed wiring, or attached to a wall. A melody bell and feather-tone buzzer combination is also included in the line, as well as the feathertone buzzer only, each housed in ivory plastic case.

Cable Electric Products, Inc., 234 Daboll St., Providence 7, R. I.

Brush (37)

Vibration-absorbing brush for rotating machinery has been introduced. Designed especially for mill type motors, the brush has a Neoprene pad actually fused to the carbon by a cement that unites chemically with Neoprene when heat and pressure are applied in manufacture. With the spring hammer riding on the Neoprene pad, the brush absorbs the vibration. Sparking and commutator grinding are also reduced.

Helwig Company, 2544 North 30th St., Milwaukee 10, Wis.

Lighting Fixtures (38)

A new line of bent glass fixtures, called "Luxury Glass", has been introduced. Fixtures come in square and round shapes in 12-inch and 16-inch sizes. Available in varied combinations of decorator colors. Glassware decorated with pastel motifs. Available for two, three and four lamps.

Brassner Products, Port Chester, N. Y.

Ramset Fastening System

Cost comparison sheet for General Contractors Inc.

This form is provided for estimating costs on any job with Ramset Fastening System as compared with present method, and to indicate possible savings with Ramset method.

In estimating fastening time with present system, use actual time of workmen doing the work, including making fastener hole, inserting plug and attaching fastener. Use same method for Ramset, which will ordinarily be less because the fastener itself is set in one operation.

Materials cost for present method should include plugs and fasteners; and for Ramset, should include both fastening charge and the fastener itself.

	Estimated Present Method	Actual Ramset System
NO. OF FASTENINGS 7186		
TIME REQUIRED	2371.4 HOURS	484.3 HOURS
COST AT $ 2.00 PER HOUR	$ 4,742.80	$ 968.60
COST OF MATERIALS	718.60	1,651.68
TOTAL COST	$ 5,461.40	$ 2,620.28
COST SAVED WITH RAMSET SYSTEM		$ 2,841.12
		52 %
SAVED PER FASTENING WITH RAMSET SYSTEM		$ .39
TIME SAVED WITH RAMSET SYSTEM		1887.1 HOURS
		79.5 %

$2,841.00 SAVED WITH Ramset FASTENING SYSTEM

FOUR MINUTES per fastening (total time on job) with Ramset System instead of NINETEEN MINUTES with his old method saved this contractor $2,841.00 on one steel fastening job. Instead of slow, laborious, costly drilling—just load the self-powered, light, Ramset Fastening Tool. Then—READY! RAM! SET! Quick, easy, economical—and tight. *Actual fastening time, less than one minute per fastener!*

Compare *your* fastening costs into steel, concrete and other hard materials. See how much time and money you can save with the simple, lightning-fast Ramset System. With 65 sizes and types of drive pins and threaded studs, you can do almost any kind of construction fastening job.

Your local Ramset Specialist will help you cut costs and show you how to "Ramset" your way into more profitable business. Write or wire us collect for name of nearest representative.

Ramset System

SAVES TIME . . . CUTS COST ON JOBS LIKE THESE:

Fastening—

- Electrical equipment.
- Wiring and conduit.
- Panelboards and controls.
- Lighting fixtures.
- Bus duct and outlets.
- Supports to concrete, brick and steel.
- Television antennae.

Stemco Corporation • Cleveland 16, Ohio

FASTEN FASTER, EASIER, CHEAPER WITH RAMSET

Steel to concrete | Wood to concrete | Wood to steel | Steel to steel | Steel to brick | Fabricated hard materials to steel | Concrete penetration | Steel penetration

KOCH

BURNING OVENS . .

. . . for burning out motor windings preparatory to re-winding, and similar uses.

Only KOCH Ovens Give You All These Advantages:

- Automatic Control of Entire Heating and Cooling Cycle
- Convenient Front Loading; Top Opens for Chain Hoist
- No Spot Heating, No Warping or Distortion of Frames and Laminations
- Approved Safety Features, Greater Cleanliness, Fewer Health Hazards
- Temperature Settings for Drying Out Water Damaged Motors, Baking Enamel, etc.

You load this new KOCH Burning Oven from the front. It accommodates smallest to largest size motors in one loading; chain hoist may be used if desired.

Temperature and timing are automatically controlled through the entire heating and cooling cycle. Door has convenient observation port.

YOU can save time and money with this new KOCH Oven. Write or wire for descriptive folder.

GEORGE KOCH SONS, Inc. EVANSVILLE 4 INDIANA

ADJUSTS WITH A TWIST OF THE WRIST

355°

PAT. 150,820 9-7-48

"Friction Set" Fixture Hangers FOR INSTANT ALIGNMENT

At last you can get a Fixture Hanger that turns to any angle after being screwed to an outlet box. Although base and receptacle remain stationary, hanger arms may be turned to align with any preconceived lighting plan. Exclusive Friction Ring firmly holds fixture in selected position. Hanger screws on to 3¼" or 4" outlet boxes, no other fastening necessary. Furnished complete with receptacle, two 5' chains, hooks and cord clips. Also available with bushed hole only, or with 3 wire solid ground receptacle. All Friction-Set Hangers are approved by the Underwriters' Laboratories.

K100 shown above, List Price $1.10 • Write for Bulletins K25, K26 and K27

SIMPLET ELECTRIC COMPANY

3600 West Potomac Avenue, Chicago 51, Illinois
11 Park Place, New York 7, New York

Rotator (39)

Ability to take an unusual amount of wind stress and to carry TV and amateur antenna arrays without overloading motor, are features of the new Tele-rotor. It will take load stress up to 300 pounds. Not only can more units be built onto antenna without overloading motor, but motor is weather sealed and lubricated for life. It is instantly reversible, and is operated by directional pushbuttons. Housing of rotator is die cast and reinforced, designed for mast or platform mounting and equipped with three heavy-duty guy-wire lugs. It will accommodate ⅞ to 2 inch upper and lower masts.

Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

Master Clocks (40)

CTR has re-designed and re-styled its entire line of master clocks, program systems and recorders. Type WM-60 master clock send out low-voltage impulses every minute, on the minute, over a two wire circuit to keep secondary clocks, recorders, program machines, bells and other signals in exact synchronization at all times. Clock operates on 105-125 volts, ac or dc. and is available in two styles.

Cincinnati Time Recorder Company, 1744 Central Ave., Cincinnati 14, Ohio.

Cord (41)

A new Koiled Kord for use in hospital signalling systems has been developed. Nurse's call button always available to patient and at the same time, when not in use, it hangs straight from the wall without tangle of cords on the floor. It is 3 ft. 9 in. long when retracted and 7 ft. 6 in. when extended.

Connecticut Telephone & Electric Division, Great American Industries, Inc., Meriden, Conn.

Instruments (42)

New pushbutton operated instruments, known as Vibropots, for earth resistivity measurements, have been announced. With an accuracy of 1% of the reading at any point on the scale and range, the Vibropot is a dc ohmmeter, an ac impedance bridge, as well as an instrument applicable for earth resistivity measurements by the four-point method. Also provides laboratory accuracy for testing resistance to earth of man-made grounds.

Associated Research, Inc., 3758 West Belmont Ave., Chicago 18, Ill.

Product Briefs

(43) Solar Electric Corp., Warren, Pa., has announced a new "Eyeease" finish on 100, 200 and 300 watt, three-light **bulbs.**

(44) Radio Corporation of America, Camden, N. J., has announced a 10-50 kv. **power supply** for nucleonics and other scientific work. . . . (45) The GS No. 3F **battery service kit** consists of a steel tray with a handle and compartments for holding battery servicing tools and water. Made by General Scientific Equipment Co., Philadelphia, Pa.

(46) Natale Machine & Tool Co., Carlstadt, N. J., has announced a new emergency portable **floodlight.** . . . (47) Federal Electric Products Company, Newark, N. J., has announced a new Noark 100 ampere **pull switch.** . . . (48) Breather vent **plugs** are available in standard square head, countersunk and specials from the U. S. Plug & Fitting Co., Cleveland, Ohio.

(49) Burndy Engineering Co., Inc., New York, N. Y., has announced a new **Hytool** for installing Hysplices. . . . (50) The "Badger" **tile drill** fits all types of fasteners and standard electric and rotary air tools. It is manufactured by A. E. Kliebhan & Sons, Wauwatosa, Wis. . . . (51) A new series of ranch **lanterns** created especially for exterior and interior use in ranch and ranch-type houses, has been announced by the Artolier Corp., Lodi, N. J.

(52) The television **Antenaplex system,** a multiple-outlet-master system is now available in all TV areas from Radio Corporation of America, Camden, N. J. . . . (53) A small, hand **Hytool** for installing Hydent connectors on a broad range of conductors has been developed by Burndy Engineering Company, Inc., New York.

(54) Two new features have been incorporated into the design of Beaver pipe **tools** heavy-duty Model-A and Model-B **pipe and bolt machines.** Beaver Pipe Tools, Inc., Warren Ohio. . . . (55) William Brand & Company, New York, N. Y., has announced **plastic insulated wire** with insulation of one-thirty-second wall of vinyl dielectric approved for 105-degree C continuous operations. . . . (56) The Oasis Model OP-5-SX pressure-type electric drinking **water cooler** for hazardous locations has been announced by Ebco Manufacturing Co., Columbus, Ohio.

(57) Blackburn Specialty Co., Cleveland, Ohio, has announced a new adjustable **ground clamp.** . . . (58) Two new "Rigid" **hacksaw frames** have been designed and are being manufactured by the Machine Rebuilding Company of Detroit, Michigan. . . . (59) The "Quick-Wedge" screw-holding **screwdriver** is manufactured by Kedman Company, Salt Lake City, Utah.

(60) The Stillson **wrench** now features a special zinc coating to resist rust and corrosion. It is manufactured by Walworth Co., New York, N. Y.

Controls for fire-fighting equipment manufactured by Maxim Motor Co. are safely insulated with "SCOTCH" No. 33 Electrical Tape. Plastic backing of tape resists water, oil and most chemicals.

FIREMEN BET THEIR LIVES

on tape-insulated wires

Dependable insulation on fire-fighting equipment calls for "SCOTCH" No. 33 Electrical Tape at Maxim Motor Co., Middleboro, Mass. Mr. S. H. Flanders, Purchasing Agent, writes—"Our products require the highest quality materials and workmanship attainable, and your tape fully meets these qualifications. It's the best."

Why not give "SCOTCH" Electrical Tapes a try on your next job? There's one designed to save you time and money on practically every insulating problem. Just write Dept. EC-2 for complete information. No obligation.

Made in U. S. A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minnesota

also makers of other "SCOTCH" Brand Pressure-Sensitive Tapes, "SCOTCH" Sound Recording Tape, "Undereal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Abrasives, "3M" Adhesives.

General Export: DUREX ABRASIVES CORP., *New Rochelle, N. Y.*
In Canada: CANADIAN DUREX ABRASIVES LTD., *Brantford, Ontario*

The KNOPP
Voltage Tester
with the
PROD-MOUNT
Saves Time,
is Reliable!

Has 5 Safety Features . . . Many Uses

Say "Goodbye to risky, time-wasting fuss in testing" with the 5 main safety features in the Knopp Voltage Tester: (1) exclusive Prod-Mounting Socket in housing making this tester easier, faster, and safer to use and ending time-wasting "three-handed" testing; (2) protection through Dual indication of voltage by solenoid and neon lamp working independently; (3) positive scale readings; (4) signal by hum and vibration; and (5) thorough insulation throughout, even to the sharp point of each prod.

Well built and shock-proof in a LAMINATED bakelite housing, the Knopp Voltage Tester tells immediately and simply if circuit is open or closed; magnitude of voltage between 110 and 600; a-c or d-c, pure or rectified; 25 or 60 cycles—for testing old and new circuits, fuses, locating grounds, etc.

Get the widely-used and reliable Knopp Voltage Tester with the Prod-Mount, and other safety features, from your dealer, or write for illustrated, free information sheets.

ELECTRICAL FACILITIES INC.
4232 Holden St. Oakland 8, Calif.

Catalogs, Bulletins and Engineering Data

(61) SLIMLINE fixture, the Luvex, is sketched, specified, and priced in 4-page bulletin 10-M. Day-Brite Lighting, Inc.

(62) SOLDERLESS CONNECTORS for all sizes of wire from No. 14 wire to 2000MCM cable, single and multiple taps, are presented in Catalog 4S by Frankel Connector Co.

(63) ELECTRICIANS' GLOVES are described and specified in file sheet 9036. B. F. Goodrich Co.

(64) MIDGET PLUG-IN BUSDUCT for either single or 3-phase service up to 50 amps. is discussed in AIA File 31C66. Frank Adam Electric Co.

(65) FLOODLIGHT POLES of tapered steel for nighttime recreation or parking lot illumination are dimensioned and discussed in Bulletin FL 102. Union Metal Manufacturing Co.

(66) ACIDITY in transformer oils is discussed and a kit for testing for acidity in the field is presented in leaflet 70 prepared by the Gerin Corp.

(67) ROLLING SCAFFOLDS of sectional tubular steel, for installation, repair and maintenance of electrical equipment, are pictured and described in Bulletin Pss 14. Patent Scaffolding Co., Inc.

(68) CAPACITOR of 3 kvar capacity, with chart for determining kvar requirements for improving power factor to any desired value, is subject of Bulletin 147. Cornell-Dubilier Electric Corp.

(69) CONTROL CENTERS are described in booklet B-4213 with discussion of safety features, plug-in disconnects, dimensions, weight of interchargeable units and basic planning. Westinghouse Electric Corp.

(70) COMPRESSORS in sizes from 15 to 125-hp. with piston displacements from 81 to 640 cfm. at 125 maximum pressure are subject of 16-page bulletin A56. Joy Manufacturing Co.

(71) D-C GENERATORS larger than 150-kw. or 0.3-kw. per rpm. are discussed as to construction, operation and application in 20-page Bulletin O5B-7229. Allis-Chalmers Mfg. Co.

(72) LIGHT DIMMING equipment for church application, with dimmer ratings and specifications, is subject of Form 9492 prepared by Superior Electric Co.

(73) DRY TYPE TRANSFORMERS 600 volts and below, both single phase and 3-phase, are covered in bulletin CS701. Instruction manual IM 110 contains information on care and operation of oil-immersed units. Both releases prepared by the Kuhlman Electric Co.

(74) DEMONSTRATION HANDBOOK containing more than 100 suggestions for lighting, care and use of appliances, motors, wiring, welding and tools discusses the 4-H Electric Program. This booklet, B-4632, contains 32 pages. Westinghouse Electric Corp.

(75) RANCH LANTERNS for exterior and interior use in ranch-type houses are described in booklet released by Artolier Corp.

(76) SINGLE AND 3-PHASE dry-type transformers, 600 volts and below with Class B insulation, are pictured, described and specified in Bulletin 61B-6382A. Allis Chalmers Manufacturing Co.

(77) PANELETTES with Quicklag Noark circuit breakers are analysed, priced and described in 8-page 2-color file folder LC 1-10-49. Federal Electric Products Co.

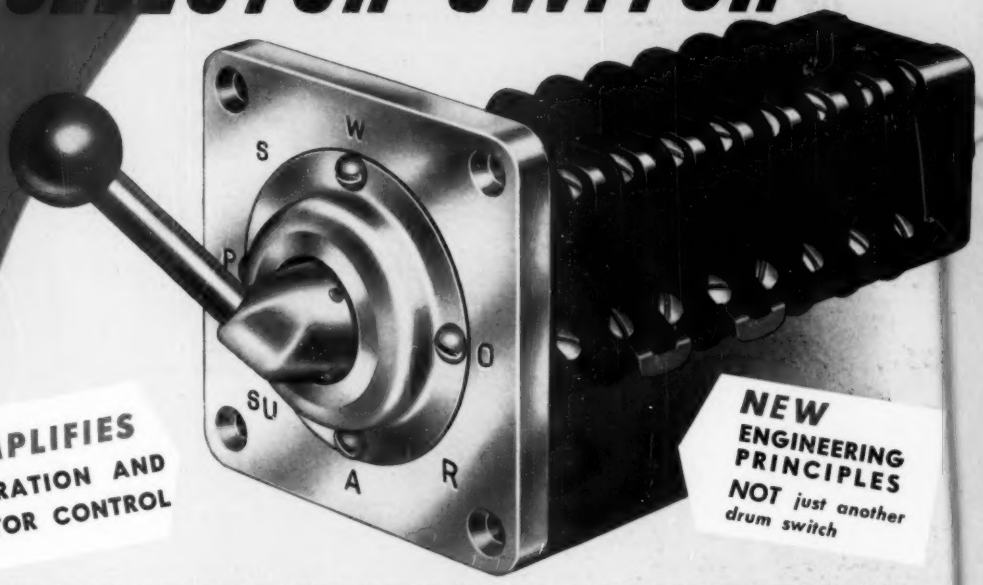
(78) INSTRUMENT TRANSFORMERS, with illustrations of application, table showing construction and sizes, and description of features, are presented in 12-page booklet B-4319. Westinghouse Electric Corp.

(79) PIPE TOOLS, machines, power drives and threading oils are discussed in new catalog prepared by Beaver Pipe Tools, Inc.

(80) INCANDESCENT lighting for commercial and institutional applications is subject of 16-page folio I-49. Gruber Brothers, Inc.

The New PUSH-PULL SELECTOR SWITCH

ARROW AH HART



SIMPLIFIES OPERATION AND MOTOR CONTROL

NEW ENGINEERING PRINCIPLES *NOT just another drum switch*

CUSTOM BUILT TO SUIT YOUR NEEDS, THIS REVOLUTIONARY NEW SWITCH CUTS YOUR CONTROL COSTS, TOO!

The new Arrow-Hart PUSH-PULL-SELECTOR Switch provides a single point of control for a multiple-operation machine. Any combination of momentary contact elements can be arranged — to act in place of push buttons, relays and contactors to start or stop action. Up to 16 dial positions are available. You can stop or start in any position. You can move from any position on the dial to any other position — without activating any of the intervening operations. Control and load circuits may be combined in as many sections as you require. Each section has 2 completely separate circuits; each can be opened or closed independently in all positions. Any combination required can be used in any position—3-wire or 2-wire control.

SEE PROOF OF THESE STATEMENTS ON NEXT PAGE

CONTROLS and APPARATUS FOR *Outstanding* PERFORMANCE

ARROW AH HART

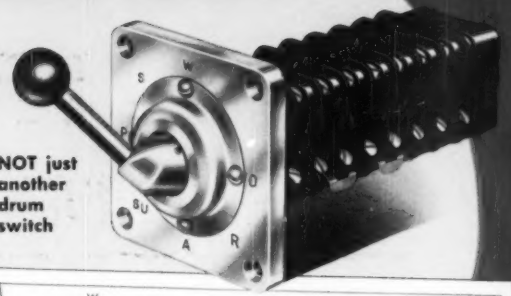
ARROW-HART

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY
103 HAWTHORN ST., HARTFORD 6, CONN., U.S.A.

SAVE TIME, MONEY AND SPACE with

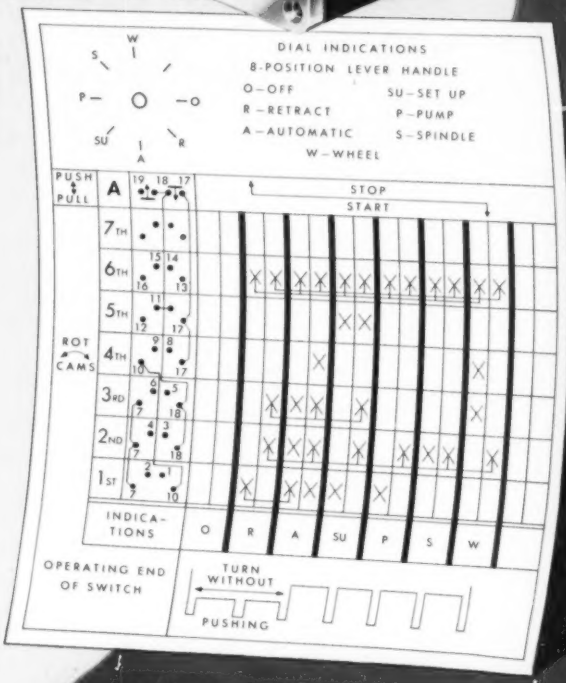
The New PUSH-PULL SELECTOR SWITCH

ARROW AH HART



Arrow-Hart PUSH-PULL-SELECTOR Switches can effect unheard-of savings in your electrical control costs. You save installation and operation time through simple, central control of multiple operations. You save money through lower initial costs and elimination of many components. And you benefit from versatility through the wide selection of circuit-positions. Safe, foolproof operation from one point of control.

The target sheet illustrated at right for the operator's control "PPS" Switch displays the legend and circuit requirements for the New Departure Ball Race Grinder. 2 "PPS" Switches and 3 starters provide complete control. Without the "PPS" Switches control could not have been effected with less than 10 push buttons and 7 starters. Savings in initial costs, installation and operation time speak for themselves!



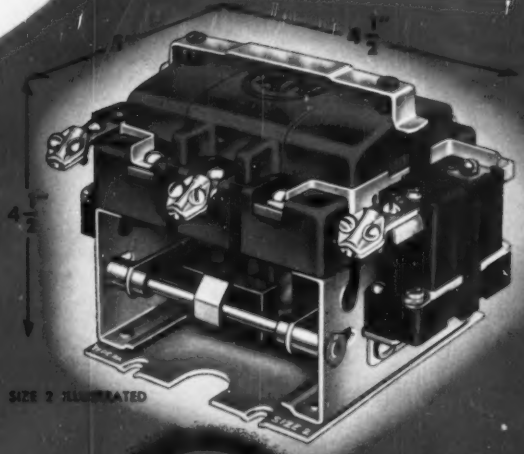
CUSTOM BUILT TO YOUR SPECIFICATIONS

Arrow-Hart PUSH-PULL-SELECTOR Switches are custom built — designed to your individual specifications by Arrow-Hart engineers. The New Departure application of the "PPS" Switch increased production to better than 20%. Similar savings are available to you. Our design, production and assembly facilities are placed at your disposal — to give you the finest in electrical control equipment.

TELL US YOUR CONTROL PROBLEM — give us your requirements — and we'll design a control unit that will give you years of economical, efficient and maintenance-free service. WRITE TODAY FOR "PPS" FOLDER and SPECIFICATIONS SHEETS.

ASK ABOUT THE NEW TYPE "DA" MAGNETIC STARTERS 1/3 size of Conventional Controls

They feature exclusive right angle balanced mechanism, larger contacts, Plaskon Alkyd hood and base. Easy to wire and service. Available in sizes 0, 1, 2 and 3 in local and remote control or selector switch types. Write for literature.



Buy with Confidence
Profit by Performance

ARROW AH HART

THE ARROW-HART & HEGEMAN ELECTRIC CO.
103 HAWTHORN ST.
HARTFORD 6, CONN.

QUESTIONS from readers on problems of industrial equipment, installation maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Reader's Quiz

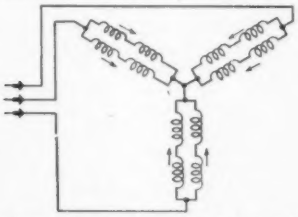
Motor Winding

QUESTION 338—In a 3 phase, 2 speed, 2 winding motor, both windings are connected 2 circuit wye. While one winding is in use, why doesn't the other act as a closed secondary?—F. H.

A. TO QUESTION 338 — The answer is that it (the other) is not a closed secondary, but its terminals are deliberately left open when the winding is not in use.

If the idle winding were not left open, it would indeed act as the short circuited secondary of a transformer, and both windings would be destroyed quickly unless protected by some quick acting overcurrent device to disconnect the motor from the line.—R. J.

A. TO QUESTION 338 — The conventional three phase, Y connected, two circuit motor winding represented by the diagram below is presumably the type of winding used for one of the motor speeds and therefore would be idle when the motor was running on the other winding. This winding might be considered as a closed circuit secondary, but since the



voltages in the two circuits of each phase would be in the direction shown by the arrows, they would be in opposition. The net result would be that no appreciable current would flow in the idle winding and therefore it would produce no noticeable effect.—R.W.H.

A. TO QUESTION 338 — The two-speed magnetic controller performs the same duty as two ordinary single duty controllers acting together, furnishing different size heaters for each winding for over-load protection, as the full load current of the 2 windings may vary as much as 2 or 3 to 1. I have had occasion to use 2 controllers for a 2 speed wye motor while awaiting delivery of a 2 speed panel. The unused winding cannot act as a closed secondary because when T1, T2 and T3 are energized, T11, T12 and T13 are opened and vice versa, as their holding-coil and interlocks are two distinct circuits, one opening the other.—J.V.H.

A. TO QUESTION 338 — Mr. F. H. has raised the question of feedback in the problem of dual windings in motors. He states that while one winding is being used, why does the second winding fail to give trouble? He also states that the windings are two circuit wye connected. The truth of it is that under most circumstances the second winding would give trouble if connected together, but the trick is in the switching arrangement of the starter. Suppose we assume that the leads of the motor are marked T1, T2, T3, T11, T12, and T13. If we put power on T1, T2, and T3, leads T11, T12, and T13 are left open. If power is placed on T11, T12 and T13, leads T1, T2 and T3 are left open. There would be no current flowing in the two parallel windings as all voltages are balanced, and no difference of potential exists between them.—J.E.C.

A. TO QUESTION 338—In the wye connections, you have only one winding of the two connected and the one connected would not be closed. You would have a voltage generated in the open second winding, but it would not be closed so it could not act as a closed secondary.—L.R.B.

A. TO QUESTION 338—In the case of a 3 phase, 2 speed, 2 winding motor connected wye there is no closed circuit in the winding not in use.

Regardless of the type of winding in a two winding motor, the motor starter takes care of the connections and always leaves the unused winding open.

The only case in which the entire stator winding remains a closed circuit during both high and low speed operation is in the case of a two speed single winding motor.

In this case, the stator winding is connected DELTA and the entire winding is in use at both speeds, the winding being tapped at the proper points to reverse the current in portions of the winding to double the number of poles and hence reducing the speed of the motor to one half high speed.—B.A.S.

Spot Welder

QUESTION 339—How do we find the correct size Fusetron for a spot welder so that we can use it at full rating and yet not burn it out?—H. S.

A. TO QUESTION 339—The Resistance Welders Manufacturers Association rates the transformers for spot welders on a 50% duty cycle. This means that the transformer is incapable of carrying its name plate current indefinitely without damage.

For this reason, the size Fusetron we recommend is 72% of the rated primary current of the welder. Such a size Fusetron fuse will permit the welder to be operated at its full capacity without damage, but will blow if the welder is overloaded.—J. C. L.

A. TO QUESTION 339—I would obtain a clip-on ammeter. When your spot welder is being used, use your clip-on ammeter on each phase, note the ampere load, then use the closest size fuse above the number of amperes utilized by the spot welder. —W. H. L.

A. TO QUESTION 339—Fusetrons, which are essentially super-lag fuses with a thermal link, are well adapted to motor starting requirements where the starting conditions are rather constant. They have been developed to the point where any reasonable overcurrent requirements can be met and regular running protection will also be provided. No data was supplied by H. S. on his spot welder. However, the current requirements of such apparatus does not compare with that of motors, generally speaking. Spot welding equipment is usually of a rugged type capable of standing rather prolonged excess current without serious damage. I would suggest a circuit breaker which embodies both cur-

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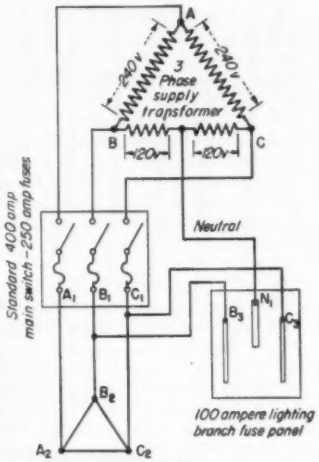
rent and time limit adjustments as the only feasible means of proper protection. Apparatus is then available for varying both the tripping limit and the time delay which should be kept within the limits recommended by the manufacturer.—W. B. M.

Series Circuit

QUESTION 340—Here is a problem that authorities disagree on, and I would like to get an answer. In rural areas, many power companies supply a combination three phase load and a single phase load from a delta connected bank of transformers, as shown in the diagram. Often the



lighting load is just connected on the load side of the main three phase fuses.

The problem develops when (for example) the main fuse B_1 blows and disconnects the load from B phase of the service. When this happens, the half of the lighting load from N_1 to B_3 is thrown in series with the motor winding A_2 B_2 and a circuit is completed from A_1 to N_1 at the transformer.

The question is: In this series circuit, will there be a detrimental de-arrangement of voltage dissipation which can force additional current through the lighting load and burn out equipment connected to the lighting circuits? Some experts say it is possible and others say it is not. —T. R. H.

A. TO QUESTION 340—This system may result in a burned out 20 hp. meter, if a lighting load of

50 amps. should be on, and fuse B 1 is burned out at the main switch and fuse A 1 is out at the motor switch, because motor winding B 2 to C 2 will have to carry the full load current without ventilation. If fuse C 1 is burned out at the motor switch, and fuse B 1 at the main switch, then you will get about 200 volts between B 3 and N 1. The lighting load will burn out and maybe also burn out the motor winding A 2 to B 2 under these conditions. If the motor is running and pulling less than full load current from A 1 and C 1, then the voltage will get low between B 3 and N 1. This can burn out 110 volt motors.—H. S.

A. TO QUESTION 340—Although the four wire Star arrangement is generally preferred to the Delta system in this part of the continent, there does not appear to be very much wrong with the arrangement shown by your correspondent, T. R. H.

As I understand it, there can be no danger of a break-through from the 240 v. to the 120 v. side, at any time, in excess of the normal line voltage, since it must be remembered that it is a characteristic of a three phase system that the voltages in each leg remain constant. The out-of-balance condition in a Delta set-up simply means that the distribution of the available voltage peaks will be upset and out of step at any given instant: leg A, for instance, will be at a maximum in one direction while leg C is at the minimum and leg B is at zero (due to the failure of that leg). This will give a single phase condition on the load side, but not greater in value than 240 v.

Damage may result to three phase motors if the local protection thereof is incorrectly rated, but since this phenomenon (caused by the setting up of heavy back emf and current within the motor windings themselves), is purely local, it will not interfere with the single phase lines. Bearing in mind that the voltage is cut off by the open circuit fuse, there is also an absence of applied voltage. The surge condition is instantaneous and even if the current could reach B 3, it would be of an order far in excess of the single phase fuse rating.

It is true that there appears to be a virtual series path from A 1 to N at the transformer, but an added safeguard is to be found in the normal practice of grounding N, either at the consumer's end or at the transformer; and this point should be checked with the supply authorities should there be any doubt as to which phase is grounded and where.—W. L. Y.

A. TO QUESTION 340—We have had actual experience

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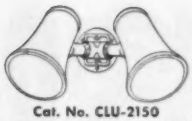

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CLUA-1
Splice box with ½" hub for one CLU-150 lampholder.

CLUA-Y1
Splice box with two ½" hubs for two CLU-150 lampholders.

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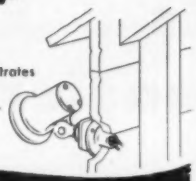

Sketch illustrates method of installation.

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with conditions as given in this question, and in each case the answer has been the same. The voltage at B-2 induced by the rotating field in the 20 hp., 3 phase motor (delta connected) will be approximately the same as when that phase connection was completed to the transformer. However, the normal current drawn by that phase will be distributed over the remaining two phases, possibly overloading those portions of the windings. Full load rating of motor will be 58% of 20 hp. or 11.6 hp.

The only current which can be drawn from the B-2 connection will be that utilized by the lighting load connected to the B phase. Of course, that load will have to be supplied through motor phases A and C which in turn will cause overloading of phases A and C in the starting equipment. When the motor stops, the lighting will go out, and it will be impossible to start the motor again due to the single phase connection through the two fuses.—M. M.

A. TO QUESTION 340—If running at the time B_1 fuse blows, the motor will continue to rotate, but at considerably reduced maximum safe output. At the same time, the motor will tend to maintain a polyphase system of voltages at its terminals, although increasingly unbalanced as the maximum safe current to the motor is approached.

As a result, voltages $C_3 N_1$, $N_1 B_3$, and $C_3 B_3$ will shift in magnitude and phase until they form a triangle. The shift will be at least when there is no load on the lighting circuit and the motor is running idle. Within reasonable limits, $N_1 C_3$ will not change. Voltages $A_2 B_2$ and $B_2 C_2$ will be reduced from the line voltage of 240, but not necessarily in the same proportion.

Any devices in the lighting portion of the system described should be protected with under-voltage or over-current equipment, especially in the case of motors operating with maximum rated loads.—L. E. B.

A. TO QUESTION 340—I believe that there will be no detrimental voltage developed across the lighting load under the conditions described. As long as the motor continues to run single phase, it will also act as a 3 phase generator, producing at point B 2, a voltage which will be very close to the voltage of point B, both in magnitude and vector location. This will tend to hold the voltage N1—B3 to a fairly constant value.

The heavier the lighting load on N1—B3, the greater will be the displacement of the voltage B2, but this displacement will be toward the center of the voltage triangle, thus reducing

the voltage N1—B3, rather than increasing it.

If, on the other hand, the motor winding from B2—C2 should open up, you would have the series circuit mentioned (A—A2—B2—B3—N1—N). The total voltage across this series circuit would be 208 volts ($120 \times \sqrt{3}$, and the voltage across the lighting load will depend upon the relative impedance of this load and of the motor winding A2—B2. If the lighting load is small (impedance high) compared to the motor winding, it is certain that a high voltage will develop from B3 to N1, burning out the lights. However, if the overload heaters, or relays, in the motor starter are of the correct size, this starter should open before any damage is done.—W. B. S.

Can you ANSWER these QUESTIONS

QUESTION D16—How do I go about designing a 500 kva. service? I start at the utility lines which are 2300 volt, 3 phase, 3 wire and wind up at distribution panels at 220 volts, 3 phase and 110 volt, 1 phase. How do I determine size and location of P.M. meters, pot-heads, C.T.'s, etc?—A.S.

QUESTION E16 — What precautions must be taken when filtering oil from an energized transformer? What should the minimum dielectric strength and maximum acid content be before filtering is required? Under what conditions would it be cheaper to replace the oil than filtering it?—J.J.L.

QUESTION F16—We have a three phase-440 volt crane operating from a trolley system some 300 feet long. At times it is very difficult to attract the operator's attention. Could someone suggest a practical means of signaling to the crane cab using the trolley system as a conductor?—W.P.R.

QUESTION G16—I have ⅓ hp., 110 volt, single phase, motor (split phase starting). This motor runs very quietly without load. When a load is applied, the motor seems to hunt. The sound is an intermittent hum which appears to be regular and seems to be at about one-half second intervals. New bearings have been applied. But the hunting persists. What is the cause of this hunting?—W.B.M.

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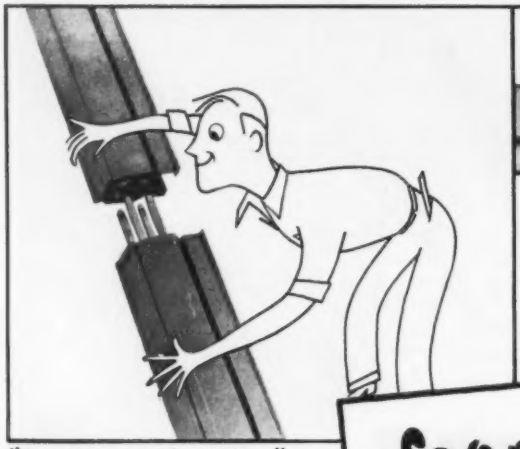

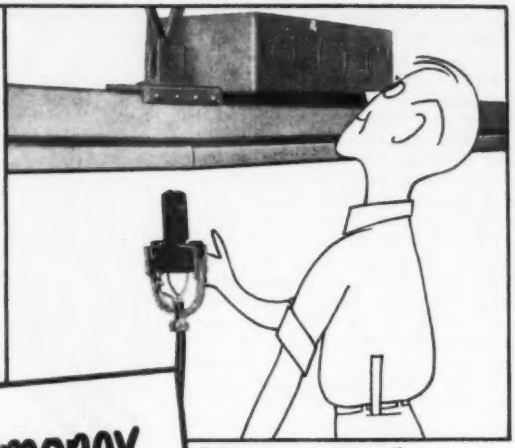

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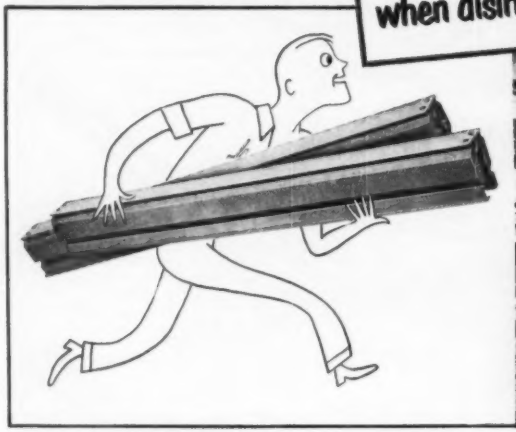

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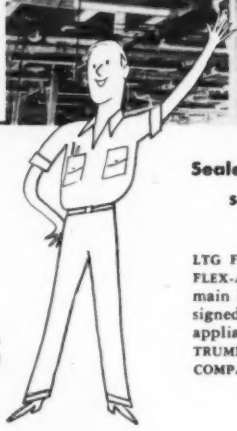

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Questions on the Code

Number of Wires in Box

Q. *A former inspector allowed 8 No. 14 conductors in a 4 inch octagonal box (no deduction for stud and clamps). Present inspector will not pass such installations. (I agree with him).*

I then switched to J. K. 4 inch octagonal box on stud bars (clamps on outside). Inspector agrees box has more area but will not permit more than seven conductors.

Using 4 inch square box and adapter cover with BX cable connectors at present, works out all right on plaster jobs, but is great inconvenience to carpenters on sheet rock ceilings. Please advise me.—A. S.

A. Section 379 of the Code permits 8 No. 14 wires in a 1½ inch by 4 inch octagonal box where cable connectors are used but no cable clamps, fixture studs or hickeys are contained in the box.

Where there is a fixture stud or hickey or cable clamps in the box, only 7 No. 14 wires are permissible. A stud on the bar hanger which places the stud within the box would make only 7 wires permissable even though the cable clamps are on the outside.

Box manufacturers have not as yet arranged the boxes to take care of sheet-rock or other wall board jobs where the side knock-outs have to be used. The first manufacturer to solve this problem will undoubtedly get a lot of trade. A little correlation and cooperation between the various building trades would also help.—F.N.M.S.

Sealing Conduit

Q. *Our new electrical inspector insists that we seal the ends of all underground conduit runs that enter any building, claiming that the Code requires it. We have made a practice in the past of sloping the conduit toward the basement so that all moisture which condenses within will drain into the basement. Now he wants us to provide a drain somewhere along the underground run and slope the conduit toward the drain point. Does the Code require such construction?*—O.D.H.

A. If the conduit runs in question consist of service runs from an underground distribution system, you will find that Section 2314 definitely requires that the conduit be sealed with a suitable compound to prevent the entrance of moisture or gases. For other underground conduit runs which terminate in a building the N. E. Code does not contain specific ruling; however, in any area subject to below freezing temperatures I believe Section 3015 should apply. This section reads:

"If portions of an interior raceway system are exposed to widely different temperatures, as in refrigerating or cold storage plants, provisions shall be made to prevent circulation of air from a warmer to a colder section through the raceway."

Experience has indicated that the warm air from the basement of a building will travel out in underground runs of conduit and when the ground around the conduit is frozen, the moisture will condense from the air and freeze. Freezing and thawing of the ice will soon injure the insulation because of the pressure exerted. Therefore I believe conduit runs leaving a heated building should be sealed to prevent the circulation of air. Where no explosive vapors or gases are present the seal might consist of any ordinary sealing compound or material.—G. R.

Service Entrance Cable

Q. *Can we use service entrance cable (of right capacity) from a service entrance switch, from the load side of switch to distribution centers in a multi-dwelling apartment (see sketch below)?*—G.S.

A. No! It is not permissible to use the uninsulated neutral type of service entrance cable between the service switch and the distribution centers..

If service entrance cable is to be used on the load side of the service switch, it must have all circuit conductors, including the neutral, fully insulated.

For a 3 wire service as indicated, a 4 wire cable could be used, using the uninsulated conductor, as a grounding wire for grounding the equipment.—F.N.M.S.

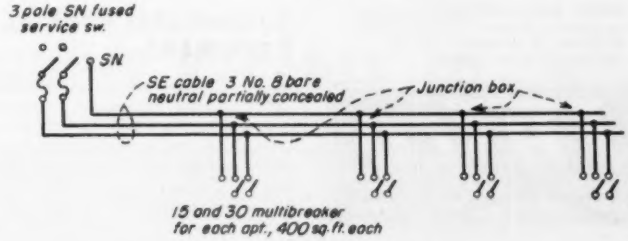
Q. *Do emergency lighting circuits have to be run in a separate conduit if they are fed from the same service?*—G.S.

A. If the emergency lighting system is independent of the general lighting system, as set forth in paragraph A of Section 7021, it must be kept independent of all other wiring and equipment.

If, however, it is installed in accordance with paragraph B of Section 7021 in which 2 or more separate and independent systems are used and either or both are a part of the general house lighting system, then separate equipment is not necessary.—F.N.M.S.

Farm Wiring

Q. *On a farm job which I have just installed, the owner wanted a single phase 220 volt and a 110 volt outlet on the outside of one of the small buildings. I obtained a weatherproof cabinet and mounted the two recepta-*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cles in it and also a fuse base so the 110 volt receptacle might be protected. This box was then served by a three wire single phase 220 volt circuit from the distribution panel in another building. The conductors were No. 8 fused at 35 amperes. A tap was made on one of the hot wires in the receptacle box for the 110 volt outlet. Now the inspector refuses to accept the job saying that it does not comply with the regulations. Is this a Code violation? —R.R.F.

A. The inspector was correct if he asked for a separate circuit for the 110 volt receptacle because as you have it connected now there is a possibility of feed back should one of the overcurrent protective devices on the 220 volt circuit open. In the event both receptacles were in use at such a time, 110 volts would flow through the windings of the 220 volt motor.—G.R.

Link Fuses and Fuseholders

Q. *We have some 600 amp. 600 volt fuse links which have been trimmed to fit a 250 volt fuseholder. Are these as much protection as a 600 amp. 250 volt fuse would be on a 230 volt circuit.*—T.H.

A. Section 2471 prohibits the use of link fuses and fuse holders of 600 amperes or less and requires that larger ones be used only by special permission.

If, however, the fuseholders were installed several years ago, before this rule was first placed in the Code, they could still be used, if in first class condition, as the Code rules are not retroactive.

However, if the intent of the question is to ascertain whether or not it is permissible to trim the renewable links of cartridge fuses, the answer would be that no change should be made to the physical shape or size of such refills. Any change made to the refills would nullify both the Laboratories' and the Manufacturers' approval.—F.N.M.S.

Commercial Cooking Equipment

Q. *Sometime ago we installed an all electric kitchen in a new cafe here and we have had one service call after another to replace blown fuses in the feeder suppling the cooking equipment. We followed the Code Table No. 29 in selecting the feeder size, in fact, we could have used even the next size smaller conductors. The electrical inspector agrees that we have complied with the Code unless Table 29 was not intended for commercial cooking devices. As we cannot find anything in the Code which infers that some other demand factor must be used, we shall appreciate your views on this matter. The load involved consisted of two restaurant type ranges, a separate oven, two broilers and two deep fat fryers and the usual toasters, coffeemakers and warming table. Possibly we were wrong in considering the oven and broilers as ranges.*—D.B.

A. Table No. 29 of the Code has long been questioned by many as numerous instances have indicated that the demand factors shown are too generous. On the other hand, the Code is simply a set of minimum standards and compliance with it does not assure an adequate or efficient installation. The installation of energy consuming devices can never be alike in all instances. periods of use are bound to vary. Hence it becomes necessary to give individual consideration to every installation. As a simple example, most homes today are wired with a single appliance circuit which may supply up to 20 amperes, yet you and I both know that if the housewife had all the appliances she hopes to have, she could not begin to use them on a single 20 ampere circuit.

Section 2203-d states "the feeder load for household electric ranges and other cooking appliances individually rated at more than 1¾kw. may be calculated in accordance with table No. 29". There can be no question but that the term "other cooking appliances" refers to restaurant equipment. Cooking appliances used commercially are subject to longer periods of use and their average use will also approach nearer their total rating than is true of domestic ranges. Hence it seems advisable to disregard Table No. 29 in determining feeder capacity and arrive at the total actual load which may be anticipated. One must bear in mind that in many commercial kitchens it is possible the anticipated load may equal the total rating of all appliances. —G.R.

Official NEC Interpretations

INTERPRETATION No. 311
Issued November 26, 1948
(Corrected)

Section 2003
Circuits Derived from Auto-Transformers

STATEMENT: Interior lighting circuits are energized by 200 volt, three-phase Delta connected generator, ungrounded.

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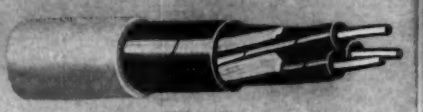
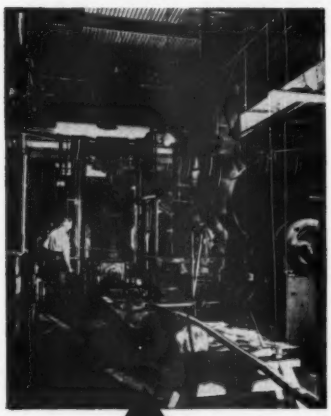


TYPE VML

LEAD COVERED CABLE

TYPE V

VARNISHED CAMBRIC CABLE



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Of This Publication
WESTERN INSULATED WIRE CO.

QUESTION: Is it the intent that Section 2003 be interpreted as prohibiting the use of an auto-transformer for deriving a 110 volt supply to the lighting circuits?

FINDING: Yes.

INTERPRETATION No. 331

Issued October 5, 1949

Article 110–384

Accessibility Required in Cubicles

STATEMENT: Service entrance equipment for the power supply to an industrial occupancy is housed in a sheet metal cubicle having appropriate compartments enclosing meters and related instruments and six other compartments within which the load is subdivided and controlled by individual circuit breakers. The cubicle is made up on an angle iron frame with sheet steel panels at sides and rear. The cubicle is located so that the spacing of its back wall from the masonry of the building wall is about 3-inches. No means are provided for access for inspection, testing, and maintenance of equipment within the cubicle without exposure to current-carrying parts, unless the connection of the service entrance conductors to the utility supply outside the building is opened.

QUESTION: Is it the intent of applicable Sections of Articles 110 and 384 of the 1947–9 edition of the National Electrical Code that such accessibility be provided by the specified separations at the rear of the cubicle from the building wall?

ANSWER: Yes.

INTERPRETATION No. 338

Issued September 20, 1949

Section 4192

Control—Electric Discharge Lamps, Electric Stairways

STATEMENT: An electric stairway (escalator) installation employs glass balustrade panels through which illumination is supplied by electric discharge lamps installed in conformity with Section 4191 of the 1947 edition of the National Electrical Code. The primaries of the tube transformers are subject to contacts on the stairway control switches so that they are alive only when the stairway is running. Overcurrent protection of these primary circuits is independent of stairway control overcurrent protection but will be subject to (1) the stairway disconnect in addition to (2) the disconnect specified in Section 4192 of the Code.

QUESTION: Will the foregoing plan of protection be acceptable in lieu of a relay, as recommended in Section 6011 of the Code.

ANSWER: Yes—subject to the limitations of Section 6201, other applicable provisions of Article 620, and those described in the introduction of the Code, see Paragraph Code arrangement.

INTERPRETATION No. 339

Issued October 21, 1949

Article 610

Section 6121—Contact Conductors

QUESTION 1: Who is to determine that a person is "qualified" and on what basis?

ANSWER: The authority enforcing the Code should be satisfied that the individual has had training under skilled and responsible supervision and also personal experience working under the electrical conditions in which the hazard arises.

QUESTION 2: What is meant by the term "Isolation by elevation?"

ANSWER: Conformity with the provisions of paragraph c of Section 1112, and paragraph c of Section 1113 of Article 1 of the Code.

QUESTION 3: What constitutes "provided with suitable guards"?

ANSWER: Physical barriers accomplishing the horizontal spacings set forth in Section 1112, paragraphs 1 and 2, in a manner acceptable to the authority enforcing the Code.

QUESTION 4: What is the intent of the term "special means of access" in the National Electrical Code definition of "Isolated"?

ANSWER: "Accessibility" and "readily accessible" imply a need for performing promptly an indicated act; for example, see Section 4411 of the Code. However, to be "isolated" and therefore not "readily accessible" has a different safeguarding purpose and does not imply that the use of portable ladders may not defeat that purpose.

QUESTION 5: What consideration may be given "Warning" or "Keep Out" notices as providing the contact conductors with suitable guards.

ANSWER: The texts of the articles in the several editions of the National Electrical Code that apply to Isolating or Guarding Contact Conductors of Cranes make no mention of this supplementary safeguarding method.

INTERPRETATION No. 342

Issued October 5, 1949

Section 4125–4150

End to End Fixture Bodies

QUESTION: Do Sections 4125 and 4150 recognize the use of nipples or short straight sections of metallic raceways as forming the specified end to end design of fluorescent fixture bodies?

ANSWER: No.

INTERPRETATION No. 343

Issued October 5, 1949

Section 2434

Taps Not Over Five Feet Long

STATEMENT: Paragraph c, Section 2434, (1947–9 National Electrical Code)—*Taps not over 5-feet long.* The initial proposal for the practice which this paragraph recognizes was concerned with vertical risers in a wiring shaft of a multi-story building and the supply and distribution of current outside of the shaft at desired floor levels, with over-current protection at this point instead of the relatively inaccessible point within the shaft.

QUESTION No. 1: May the taps specified in this paragraph, when run in conduit or electrical metallic tubing from an open or metal-enclosed bus,

supply independently mounted, enclosed, externally operable fusible switches and/or circuit breakers?

ANSWER: Yes.

QUESTION No. 2: How many such switches or circuit breakers may be served from a bus, as in Question 1, when the specified limitations in paragraph c are satisfied?

ANSWER: The number is not limited.

QUESTION No. 3: Is there a conflict in the text of paragraph c with respect to enclosure of conductors of the tap, "except at the point of connection to open wires on insulators?"

ANSWER: No thought of conflict need be entertained in view of the original application of this provision for locating over-current protection at the load and instead of the supply end of the tap.

INTERPRETATION No. 341
Issued November 23, 1949

Section 2524
Two or More Buildings Served by A Single Service:

STATEMENT: A group of buildings at a location under operation by a single management includes one building in which is located individual service equipment, meters, and the like. This service is grounded through a made ground since water pipe electrode is not available. Other buildings in the premises have individual units of service entrance equipment and feeders or branch circuit controls supplied by individual or separate service entrance conductors from the first building; each of these individual sets of service entrance equipment have available water pipe systems and are grounded thereto within the respective premises.

QUESTION: Does section 2524 of the National Electrical Code require that the individual services be grounded to the nearest available water pipe in each case and that, in addition, there be a ground at the service entrance equipment for the building at which metering is provided?

ANSWER: Yes.

INSTALLATION TECHNIQUES ***get a thorough airing at Springfield, Ill., contractors meeting by: (L to R) H. A. Kamlager, Canton, Ill.; F. J. Majdic, Farmington, Ill.; and E. F. Buehler, electrical engineer, J. C. Schafer Electric Company, Peoria.***

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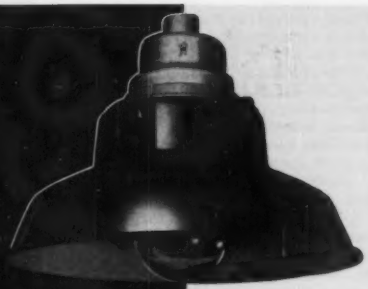

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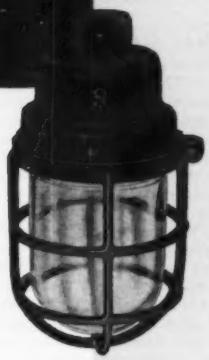

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Industrial Electrification

Pipe Line Electrification

Crude oil and gas transmission lines depend upon electrical equipment, controls and circuit know-how for efficiency and maximum production.

By M. A. Hyde
Industrial Engineering Department
Westinghouse Electric Corporation
East Pittsburgh, Pa.

THERE are three basic requirements for electrical pipe line service. First; continuity of operation, including reliability, safety, efficiency and low maintenance. Second; flexibility, pertaining to changes in operating schedules. And third; the effective use of operating personnel.

These requirements already have been attained in the electrification of crude oil and products pipe lines and they are equally attainable with gas transmission lines.

Motors for Pumping

Let us start where the electrical system goes to work—at the pump drive. For pipeliners place primary importance on the ability of electric pumping equipment to perform reliably, safely, efficiently and with low maintenance. Although each project has unique conditions affecting choice of pump type, unit size, number of units per station and basic station layout, motor application procedure is essentially (1) determining the motor horsepower, speed and type to give the most advantageously sized and coordinated pump units and (2) determining the type of motor construction as to enclosure and ventilation, jointly with the station layout.

Where line conditions make reciprocating pumps advantageous, the drive may be furnished either by a high speed induction motor through speed reduction, or by a synchronous motor directly coupled.

Under most conditions the centrifugal pump is preferred, and here the squirrel cage induction motor is best suited, performing with good efficiency and power factor. Not only does it make the simplest, and hence most reliable, installation, but it is the type most readily available in construction suitable for atmospheres containing hydrocarbons.

Selection of the number of pump units per station, together with their horsepower and speed, should be based on consideration of the pump and motor as a combined unit. It is ordinarily advantageous to subdivide the station pump capacity into two or more units. These units are usually operated in series with by-pass piping to permit shutdown of any units. For a given liquid in the line the pressure developed at each station is then determined by the number of units operated.

For greater flexibility in handling changes in line throughout, viscosity and specific gravity, with constant speed motor drive, the pumps may be designed for different heads, and operated in different combinations to put up the required total station head. Distribution of operating units must be maintained so that the suction pressure at each station is above the lower limit for safe pump operation, the discharge pressure is within the allowable working pressure for the pipe, and the pressure gradient between stations clears any local high points in the pipe line topography.

In selecting the form of motor enclosure and ventilation, the choice depends upon considerations of overall cost and reliability, including safety, with respect to station layout. Squirrel cage motors are available in no less than nine types of enclosure construction, listed in the order of roughly estimated average installed cost, including duct work and auxiliary ventilation equipment where necessary:

1. Open
2. Drip proof (cost same as open)
3. Open (or drip proof) with air discharge to duct
4. Splashproof
5. Enclosed, forced ventilated through supply and discharge ducts.
6. Enclosed, self ventilated through supply and discharge ducts.
7. Enclosed, fan cooled
8. Enclosed, inert gas filled

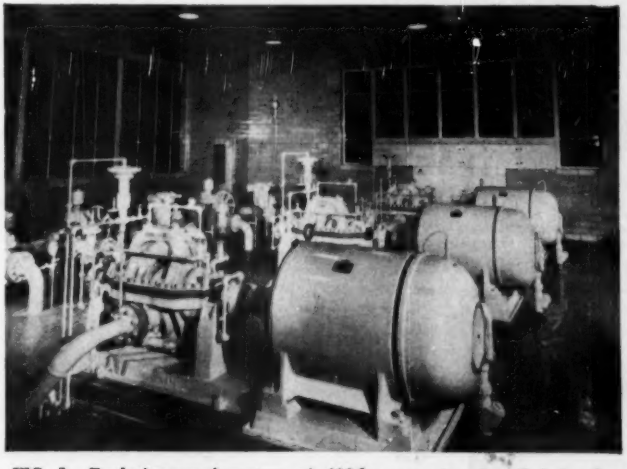

FIG. 1—*Explosion-proof motors of 400-hp. capacity, installed in the pump room of Humble Pipe Line Company's Baytown station, are controlled from switchgear and control desk in glass-enclosed room visible in background.*

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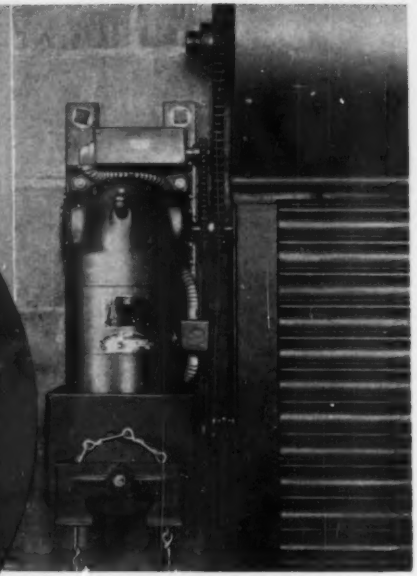
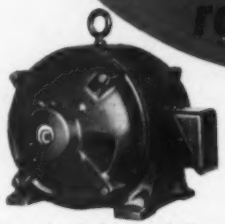


Century ⅓ horsepower gear motor operating a door opener



Multi-speed squirrel cage polyphase motor suitable for applications requiring a range of constant speeds for process or temperature control.

Wound rotor polyphase motors for constant, adjustable varying speed, reversing the direction of rotation and low starting current applications.

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CENTURY builds a complete line of electric motors to meet all popular electric power requirements. Whether DC or AC, single phase or polyphase —from 1/6 to 400 horsepower, there's a Century motor that will meet your needs.

Century motors are available to meet all types of atmospheric hazards, indoors and outdoors. You can have them with drip proof, splash proof, totally enclosed fan cooled, and explosion proof frames.

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- Wound Rotor Motors — 1 to 400 H.P.
- Synchronous Motors — 20 to 150 H.P.

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- Split Phase Induction — ⅛, ¼, ⅓ H.P.
- Capacitor — ⅛ to 20 H.P.
- Repulsion Start, Brush Lifting, Induction — ½ to 20 H.P.

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- ⅛ to 300 H.P.

GENERATORS
- AC, .63 to 250 KVA
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Ball Bearing motors are factory lubricated for several years' normal service. Bearing housing construction permits easy re-lubrication when unusual service demands it.

9. Enclosed, explosion-proof (less costly than inert gas filled motor in ratings below 700 hp., 3600 rpm. and 500 hp. 1800 rpm.).

First consideration in selecting the type of motor construction is whether the motors will be separated from the pumps by a fire wall. For where a fire wall is used, the motor location is treated either as a non-hazardous location or more usually as a Division 2 location (hazardous only under abnormal conditions) and motors of the squirrel cage type are applied with enclosures for mechanical protection and the required ventilation.

In small installations involving no serious problem in removal of heat from the motor room, open motors suffice, although for mechanical protection drip proof construction is preferable, and available at no cost increase. Splashproof and totally enclosed fan cooled motors are more costly and have no advantages for this type of installation. For larger installations, using motors say 250 hp. and above, where considerable loss heat must be removed from the motor room, it is advantageous to install motors having open or drip proof end brackets and enclosed frame arranged for air discharge to a duct leading outside the building. Typical of this practice were the installations on the War Emergency Pipe Lines.

The inconvenience of overhead ducts may be avoided by installing motors with air discharge at the bottom of the frame into an underfloor duct terminating outside the building. This arrangement is used in several booster stations just going into service on a newly looped 16-inch crude line from West Texas to Oklahoma, employing four and five 1000 hp. units per station.

Where the station is designed without a fire wall, a simpler, less costly, and more convenient building results, but the motors must be suitable for operation in atmosphere containing hydrocarbon vapors. The simplest and most reliable installation is provided by the explosion-proof motor. This type is available in ratings up to 1250 hp. 2 pole and 800 hp. 4 pole, at 2300 volts. Explosion-proof motors have been used extensively, particularly on refined products lines. One large system, Plantation Pipe Line Company, has approximately 60 such units on main line pumps, in ratings of 600 hp. and 900 hp. at 3600 rpm. Motors of the same type are used in Humble Pipe Line Company's products line from Baytown to Irving, Texas. (Fig. 1).

For ratings exceeding the capacity of explosion-proof construction the inert gas filled motor is available. This

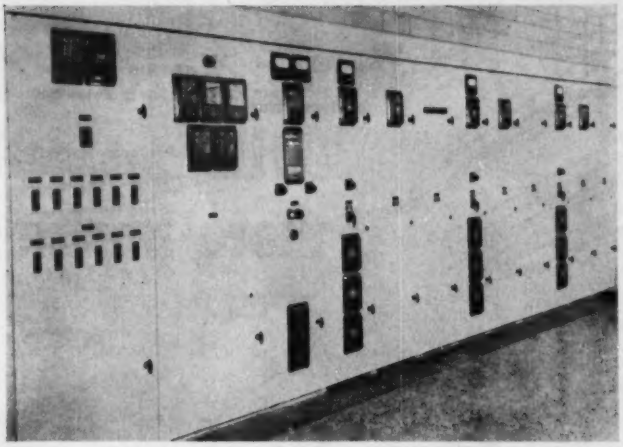

FIG. 2—*Metal clad switchgear includes a control for the main breaker, reduced-voltage motor starting equipment, auxiliary relay section and a section for the distribution of auxiliary power and lighting circuits.*

type has been built in ratings as large as 2250 hp. for use in processing operations, and larger ratings are available. However, its comparative complication and dependence upon a supply of inert gas and cooling water make it relatively unattractive for pipe line service.

Where motors are required beyond the ratings practical in explosion-proof construction, the forced ventilated motor is sometimes used. Ordinarily, the pipe line station is in a location where a reliable source of safe air is readily obtained. An individual ventilating duct system should be provided for each motor, pressurized by a blower at the air intake and discharging outside the pump room. The control system should be arranged to purge the duct system before starting the pump motor and to prevent starting or operation in the absence of ventilation. Use of forced ventilated motors with these features is preferable to installing motors of the self-ventilated type, which are higher in installed cost and do not provide for pressurizing the air intake duct nor for prepurging the system.

Motor Starting

In determining the starting equipment to be used for main line pump motors, the principal factors are (1) the size of the units, (2) whether they will be started on full or reduced voltage, (3) required interrupting capacity, and (4) the location of the starters with respect to the hazardous areas.

Unit size and method of starting should receive consideration in the determination of the number of pump units per station. Within economic limits, subdivision of the station capacity into a number of units is advantageous, not only for flexibility in line operation, but also because it improves power service conditions by reducing the motor starting demand in relation to the running load. This may mean the difference between use of full-voltage starting or the more complicated and expensive reduced-voltage starting equipment. In arranging power service, every consideration should be given to the use of full-voltage starting as an economy in electrical equipment. Since the service is usually through transformers carrying no other load, and the starts are very infrequent, it is feasible to use full voltage starting in a remarkably large percentage of cases.

It is advantageous to standardize on equipment throughout the line, so the interrupting rating is usually determined by the maximum requirement at any station site. This may justify use at the limiting station or stations of transformers having higher than normal impedance.

Motor starting equipment is available at interrupting capacity levels of 25,000 kva., 50,000 kva., 100,000 kva., 150,000 kva., and higher. The interrupting requirement for a station having as large as 5000 hp. running load. if served through an individual transformer substation, ordinarily will not exceed 100,000 kva.

Motor starting equipment may utilize contactors, or contactors in combination with current limiting fuses, or circuit breakers, as determined by the motor horsepower rating, the interrupting requirement, and the grade of service performance to be realized.

For trunk line service, there is a growing trend to the use of circuit breakers in unitized metal clad switch-

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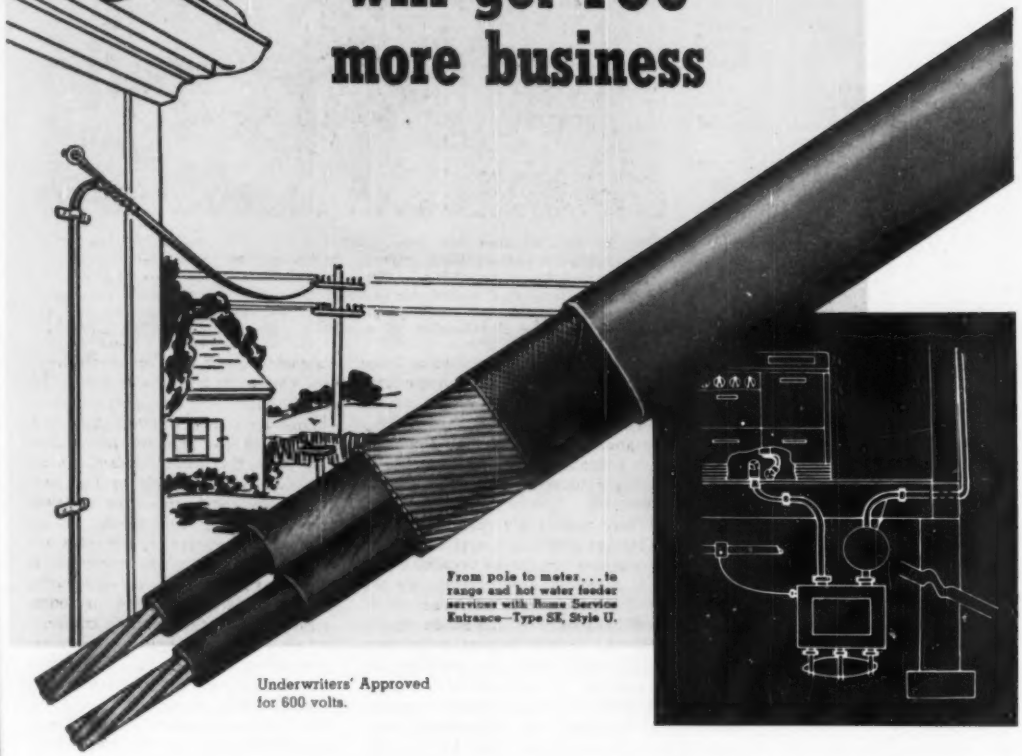

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gear. While this equipment is highest in first cost, it has some important advantages for pipe line operation. The circuit breaker, operating relatively infrequently, requires a minimum of maintenance. This is particularly true of air circuit breakers. The low maintenance requirement may be attributed at least in part to the fact that the circuit breaker does not drop out on momentary voltage dips and then reclose with a heavy current surge to the motor, as does a contactor with time-delay under-voltage relaying. The circuit breaker eliminates the need of fuses with the attendant problems of replacement stocking and possibility of single phase operation. With removable breakers and an interchangeable spare breaker, maintenance work on the breaker units is performed with minimum down time, and in the event of breaker trouble, the spare provides insurance against a prolonged outage. The removable breaker provides a disconnecting means of the safest type. In fact, metal clad switchgear provides the ultimate in safety to both the operating and the electrical maintenance personnel.

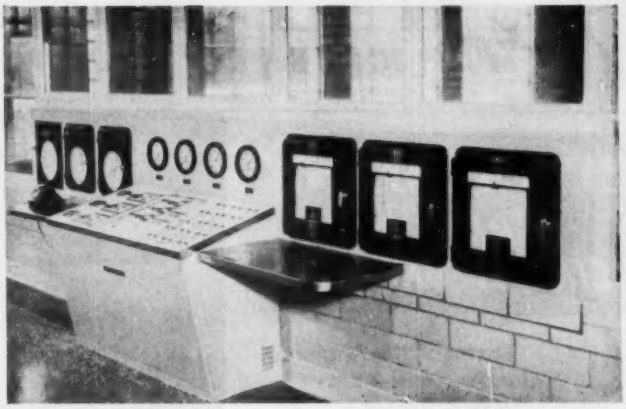


FIG. 3—*Control desk has clear plastic surface over simplified diagram of pump units and auxiliary piping. Indicating lamps mounted on diagram reveal system conditions. Meters are both indicating and recording.*

Location of Control Equipment

Since control equipment for hazardous areas is relatively expensive and inconvenient to maintain, it is usually advantageous to install the motor control outside the pump room. With this practice the possible locations for the control equipment are:

(1) At the transformer substation. Where the substation is owned by the pipe line, it may be combined with the motor starting switchgear to form a unit substation. This location entails outdoor construction, which is much less expensive and more readily accessible than that for hazardous locations, and is usually somewhat less costly than standard indoor equipment plus building space. However, this arrangement involved extensive runs of individual power and control circuits to the pump building. Also, it is inconvenient on those infrequent occasions when trouble-shooting and maintenance work must be done in inclement weather.

(2) In a building separate from the pump room, which building may also house office, storeroom, and other facilities. This permits use of the least expensive indoor type equipment, but involves substantially the same circuit runs as (1).

(3) In the motor room when a fire wall provides separation from the pump room. Usually, the motor room is not pressurized and is considered a Division 2 hazardous location, requiring starting equipment to have all arcing parts explosion-proof or oil immersed. This involves additional apparatus cost, and for metal clad switchgear the construction is uneconomical. This location has the advantage of minimum circuit runs.

(4) In a room of the pump building, having no direct communication with the pump room or motor room and maintained non-hazardous by pressurized ventilation. Conventional indoor starting equipment is used. This arrangement involves short runs for the individual power and control circuits. It is an arrangement largely used in present-day installations.

The installation at Humble's Baytown station, (Fig. 2), typical of the use of indoor metal clad switchgear, comprises control for a main breaker, three reduced-voltage motor starting equipments, an auxiliary relay section, and a section for auxiliary power and lighting distribution.

The Shell Ozark project is another example of this practice, with switchgear located in a separate room with pressurized ventilation from the blower room. Should failure occur in ventilating air flow to the switchgear room, a vane switch in the air duct will notify the operator by sounding the station alarm and lighting an indicating lamp on the station control desk. The operating room, where the station control desk is located, is similarly ventilated. In the event of an emergency involving possibility of the entrance of hazardous atmosphere to the operating room or to the switchgear room, by means of an explosion-proof emergency pushbutton at the control desk or a similar pushbutton on the switchgear, the operator can safely trip the main breaker feeding the station. This breaker is located at the transformer substation.

The main pump motor control is metal clad switchgear, 4160 volts, with air circuit breakers of 100,000 kva. interrupting capacity. The switchgear includes bus surge protection for the motors.

Each main pump unit is provided with time delay undervoltage protection, also short-circuit, locked rotor, single phase and thermal overload protection. A temperature relay actuated by an exploring coil in the motor stator warns the operator in case of over-temperature in the windings, as might occur in event of inadequate ventilation. The switchgear includes a temperature indicator with transfer switches whereby the motor winding temperatures at the various exploring coils can be selectively indicated. This permits a check on the adequacy of ventilation for the load being carried on each main motor.

Beside the motor bearing temperature relays previously mentioned, each unit is protected by similar temperature relays in the pump bearings and pump case, also by low pump suction pressure and high pump case pressure relays. Excessive pressure on the pump side of the station throttling valve will actuate a relay to shut down Unit 1 or Unit 2, or both if operating. A high station discharge pressure relay will shut down all units in event of excessive pressure on the line side of the throttling valve. These relays are of the Mercoid type, in explosion-proof housings, mounted in cabinets in the pump room. Each cabinet includes a Run-Stop pushbutton permitting the unit to be shut down and locked out (but not restarted) from the pump room. Each Mercoid cabinet is factory-assembled, wired to terminal junction boxes near the base, from which sealed conduits will run to the switchgear.

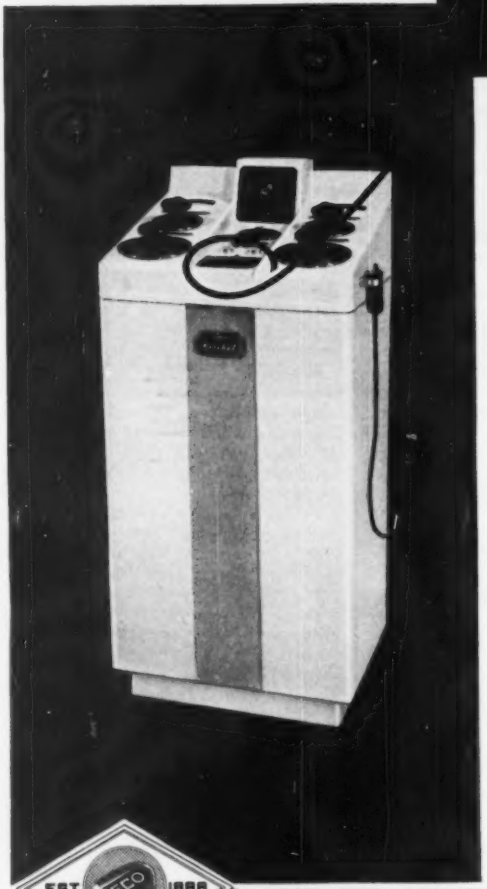
"This unit serves us very well"

THE KELLEY-KOETT MANUFACTURING CO.

HEINEMANN MAGNETIC CIRCUIT BREAKER

Protects the Valuable Equipment Shown Below

Two Pole - All Purpose, Magnetic Circuit Breaker, 15 amps., 250 Volt.



The Kelley-Koett Manufacturing Co. of Covington, Kentucky, is well pleased with the efficient, flexible protection provided by HEINEMANN CIRCUIT BREAKERS for the equipment it manufactures. The Breaker shown above is used as a combination Main Line Switch and Overload Circuit Breaker. It is placed in the circuit where the tripping coil is shunted by a tapped resistor, thereby allowing an adjustment for tripping it at various loads.

Positive protection is provided against dangerous overload by the INSTANT trip of the breaker, while flexibility is secured by a time-delay device that permits minor overloads to pass for a limited period of time.

Dangerous arcing is prevented by a high speed blow-out.

The equipment that YOU manufacture deserves the same certain protection at all times. Write NOW for further information.

EST. HECO 1888

HEINEMANN ELECTRIC COMPANY

132 PLUM STREET **TRENTON, NEW JERSEY**

A coordinated control system for each pump unit combines the motor switchgear with the control for the pump suction valve, discharge valve and venting valve, also the motor ventilating blower and the protective relay cabinet.

When the station operator desires to start a unit, he merely pushes the start button for that unit and the following operations occur, in sequence:

(1) The ventilating motor starts.
(2) The vane switch at the duct discharge checks the flow of air through the motor ventilating system. If vane switch responds to air flow
(3) A timing relay provides an interval of blower operation for purging the duct system.
(4) Simultaneously with (1) the motor-operated pump suction valve begins to open, and
(5) The pump casing is vented by opening a vent valve to the station sump.
(6) At the end of the purging interval, the pump vent valve is closed, and, if the suction pressure is above predetermined minimum and the air vane switch registers air flow,
(7) The pump motor starts. When this occurs
(8) The motor-operated pump discharge valve opens, completing the starting sequence.
(9) The sequence of starting operations is checked and if completed within the prescribed time the unit proceeds in operation, otherwise it is stopped. After the starting sequence is completed, any deviation of the suction or the discharge valve from the fully open position will shut down the unit.

To stop the unit, the attendant pushes the stop button, whereupon:

(1) The motor circuit breaker opens to stop the pump.
(2) The pump suction valve closes and simultaneously
(3) The pump discharge valve closes.

The same shutdown sequence occurs upon functioning of any of the automatic protective devices. In case of stoppage by power failure the valves will close upon resumption of power.

The consoles are equipped with green and amber indicating lights to show the position of each pump suction and discharge valve. Red indicating lights, in conjunction with the audible station alarm, identify the several unit protective functions already mentioned, also high level in the sump which receives drainage from the pump vents and glands, low air pressure to pneumatic controls, and low air supply to the switchgear and operating rooms.

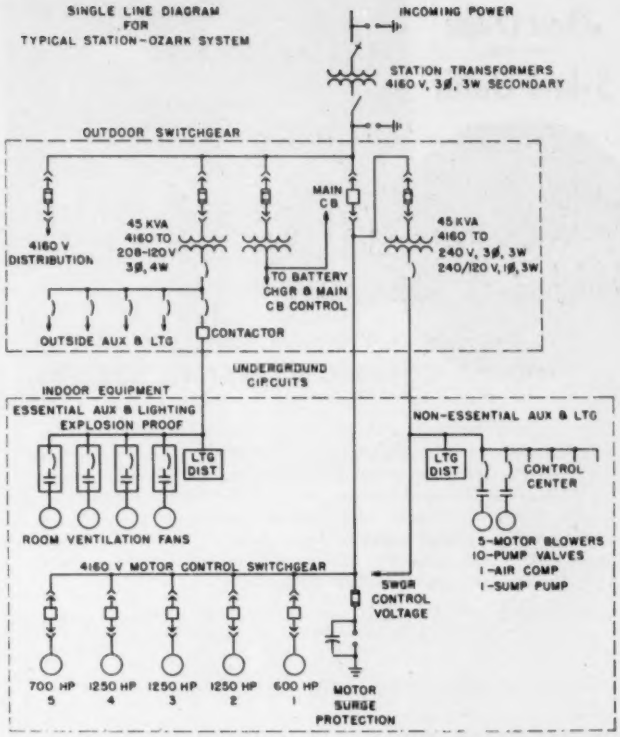


FIG. 4—Single line diagram of typical pumping station indicates relation and extent of outdoor and indoor equipment. Main breaker relaying includes overcurrent, phase failure, phase reversal and phase balance protection.

Green and amber indicating lights supervise the two exhausters which maintain ventilation of the pump room.

An alarm reset button is pushed to silence the alarm, and this extinguishes the corresponding red indicating lamp if the abnormal condition has ceased.

The installation of a single-section control desk in Humble's Baytown station (Fig. 3) shows that the console has a top surface of clear plastic, the under side of which bears a simplified diagram of the pump units and associated piping with an opaque white background. The pushbuttons and indicating lamps show through clear openings in the diagram, and the pushbuttons have flush trims, so the top of the console presents a smooth durable surface, easily cleaned, and there are no projecting devices subject to breakage or accidental operation.

Circuit Layout

In the Ozark stations, previously mentioned, the principal station load is fed through a main breaker located at the transformer substation, (Fig. 4). The main breaker relaying includes overcurrent, phase failure, phase reversal, and phase balance protection,

The 4160-volt circuit to the pump motor bus is tapped to a transformer serving the "non-essential" lighting and auxiliaries, which are thereby interrupted when the main breaker is opened. Devices on this circuit may or may not be designed for hazardous atmosphere, depending upon their location. A conventional control center installed in the switchgear room includes the reversing controllers for the motor operated valves, and starters for the main pump motor blowers, the air compressor, and the sump pump.

Opening the main breaker kills all circuits within the station except a so-called "essential" circuit carrying the room ventilating fans and certain lighting. On this circuit all devices and wiring within the station are explosion-proof. Operation of the emergency pushbutton also clears the "essential" circuit through a contactor at the substation, but this contactor can be reclosed from a separate pushbutton to permit the room ventilating fans to run and to energize the lighting.

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Trade-Mark
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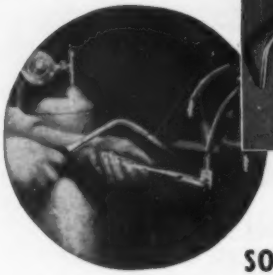

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440 VOLTS.
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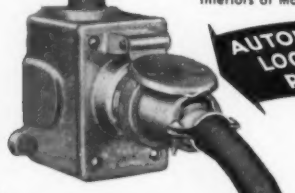

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Precision-Built Electrical Equipment
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SINCE 1902

The main breaker, and the auxiliary power and lighting transformers with draw-out primary fuses, are mounted in outdoor metal clad switchgear at the transformer substation. The main breaker is interchangeable with the indoor motor breakers, permitting a single spare breaker to serve all 4160-volt breaker units. All circuits from the outdoor switchgear to the pump station building are underground.

Simplified Operation

The salient feature of these modern installations is simplified operating procedure. This means reliability in maintaining operating schedules, an all-important factor in pipe line economy. The old method of starting or stopping a pump unit requires the operators to engage in a series of separate manual procedures in different parts of the station, including hand operation of valves—a task that becomes quite laborious in "big inch" sizes. With centralized pushbutton control, an attendant in the control room—where he has continuous contact with the line dispatcher—initiates the control sequence and then supervises the automatic performance of the necessary steps for starting or for shutting down the completely coordinated pump unit.

Each project requires consideration of the range of choice between the two extremes of design, from the fully manual station where the operators do everything "the hard way", to the robot station where the operator spends most of his time standing watch and doing maintenance work.

But what about the cost of these modern semi-automatic stations? Well, the overall cost of the Ozark system, including the value of the existing 10-inch pipe line as utilized in the project, will be approximately $36 millions. Of this, electrical equipment, including the power transformers at the station sites, switchgear, motor control, motors, ventilation apparatus, valve operators, protective temperature and pressure relays, and electrical facilities for flow control at the tankage at each end of the line, plus installation expense for all these items, will total about $1½ millions, or about 4% of the total project.

Suppose as an economy measure it were decided to install in these stations manually operated valves and no centralized control for the pump units. This would effect a saving of perhaps $200,000 in station valve operators and electrical control apparatus installed, slightly over ½ of 1% of the project cost. This is an appreciable item, but its value is small compared to the results to be obtained in the efficient operation of the system at maximum throughout.

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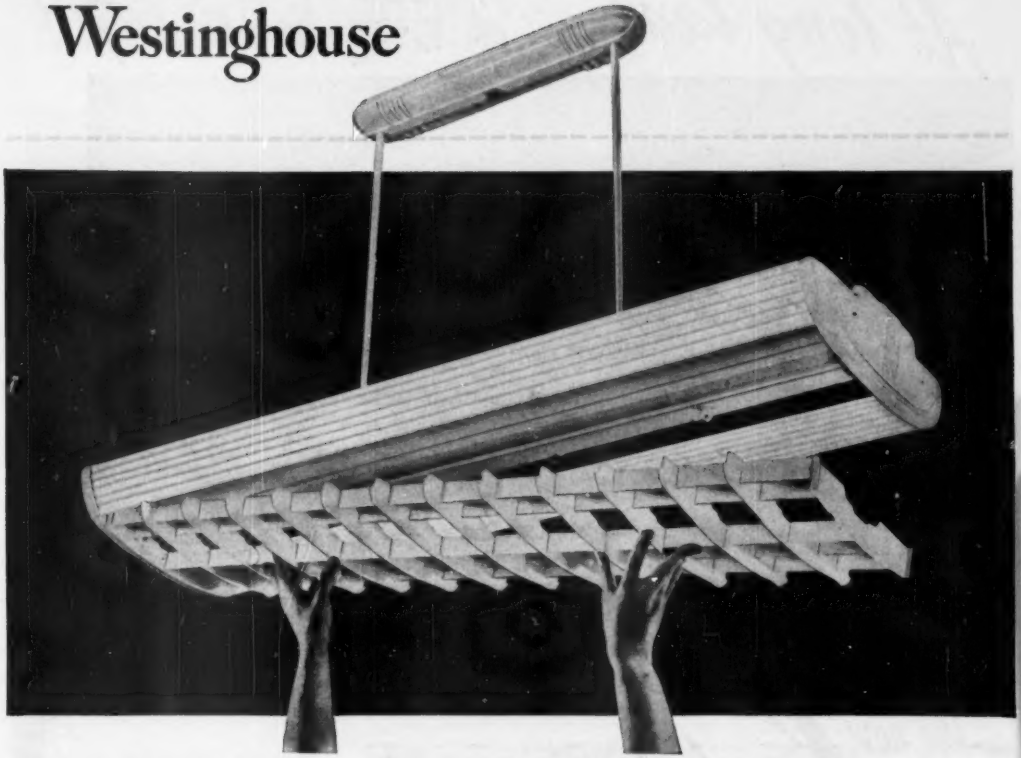
Westinghouse



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IN A JIFFY!

Light weight, CD-80 and CD-160 fluorescent luminaires for schools and offices are easy to handle—quickly installed—easily maintained.

Louvers or plastic bottom panels may be removed in a "jiffy" for routine cleaning—then just as easily replaced. This means full efficiency of the luminaire at all times—and a timesaver for the maintenance man.

This is but one of the many features of the famous CD series, designed especially for schools and offices. Specify Westinghouse to get lasting performance and quality illumination.

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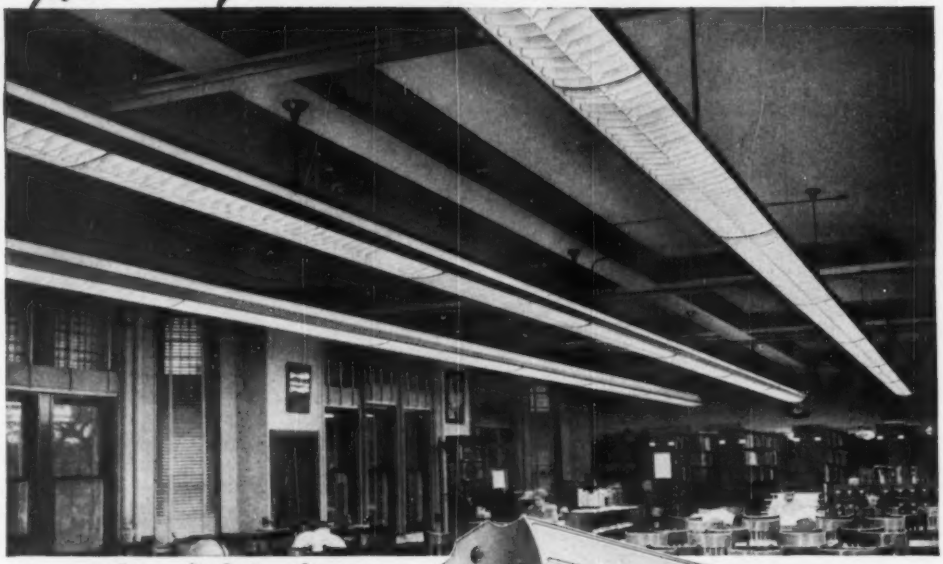
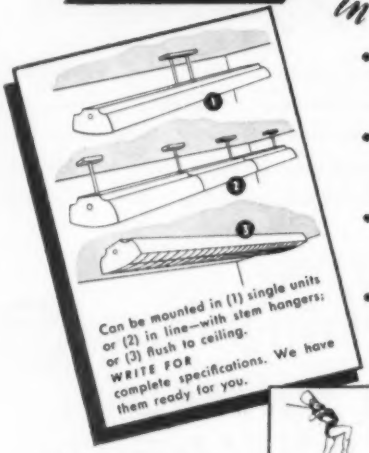


—a long lighting-fixture at a "short" price:

V-280

the new Leader Slimline VARSITY in various one-piece lengths up to 8 ft.



Can be mounted in (1) single units or (2) in line—with stem hangers; or (3) flush to ceiling.
WRITE FOR complete specifications. We have them ready for you.

- **ECONOMY**
  Long fixtures mean fewer fixtures required—fewer fixtures to buy, to install, to lamp, to re-lamp. And the LEADER Slimline VARSITY—a quality-built fixture—is priced to fit tight budgets. In every way, an economy buy!
- **SLIMLINE LAMP ADVANTAGES**
  Instant-starting . . . more light per watt . . . long life . . . handsome appearance . . . easier maintenance—single pin bases permit easy, quick relamping . . . Choice of brightness levels—more accurate light control.
- **"40-60" LIGHT DISTRIBUTION**
  Due to its efficient design, the Slimline VARSITY illuminates directly and indirectly. 60% direct light is cast downward. 40% indirect light is cast upward . . . minimum shadow.
- **MODERN BEAUTY**
  A streamlined, sleek avenue of light that shouts "up-to-date" in every way. A long, glossy, baked-enamel fixture—beautiful in its simplicity—at a beautifully low price.

No. V-280 Slimline VARSITY Specifications:
Fittings for two 75-watt Slimline lamps—available in various lengths up to 96". Instant-start, 100, 200, 300 and 425 milliampere operation. 18 gauge steel housing and channel. High-gloss baked enamel finish. 110-125 volts, 60 cycle A.C. Other voltages available.

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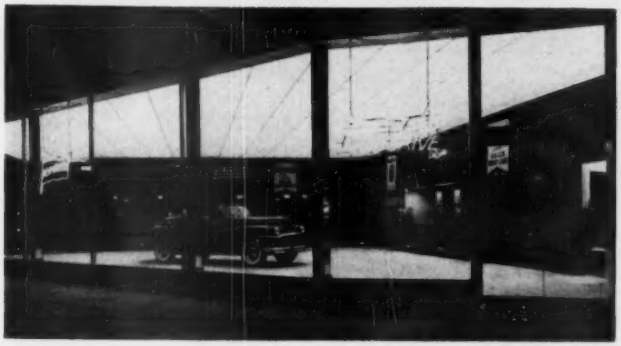
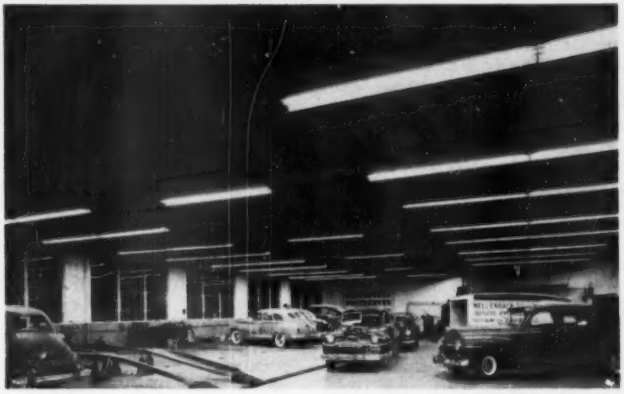
Modern Lighting



New cars are attractively lighted by slimline lamps, shielded by plastic louverall ceiling, in Nellenback Bros., Inc. new showroom, Syracuse, N. Y.



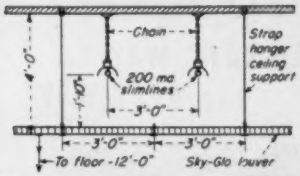
Slimline lamps in industrial reflectors provide shadowless illumination in the service and repair shop. Intensity is about 40 footcandles.

Slimlines Light Auto Showroom

In planning the lighting for their modern new auto showroom and service department, Nellenback Bros., Inc. of Syracuse, N. Y., had definite objectives in mind. First, they wanted to light the showroom to display the Plymouth and DeSoto cars for which they are dealers as attractively as possible without the use of exposed light sources. Second, they wanted to light the service department adequately so that an even intensity of well diffused light would be available throughout the entire area which would permit mechanics to properly service and repair the cars quickly and easily with a minimum of shadows from the lighting equipment on the work being performed.

The showroom, of irregular shape, has floor-to-ceiling glass on two sides. The ceiling height is 16 feet. Radiant floor heating is used throughout to heat the one-story building.

To light the showroom according to the desired objective, a Benjamin "Sky-Glo" louverall ceiling was installed with the bottom of the egg-crate design plastic vinylite louvers 12 feet from the floor. Slimline T-8 96-inch lamps were installed 22 inches above the top edge of the louvers on continuous wireway, spaced three feet on centers and operated at 200 ma. This averages about two watts per square foot and provides a horizontal lighting intensity of 28 footcandles, and a vertical intensity on the sides of the cars



Section through ceiling shows relation of slimline lamps and reflector equipment to the suspended louver ceiling.

of about 10 footcandles. Readings were made after 2300 hours of operation, and therefore represent average "in service" intensity. The initial horizontal intensity was approximately 50 footcandles.

The area above the louvered ceiling is painted flat white. The side walls are of plaster and wood, with green finish having 10 percent reflection on plaster and polished texture birch wood finish with 25 percent reflection. The floor is tan terrazzo, with a 20 to 25 percent reflection factor.

In the repair shop a quantity of 43 Eastern Fixture Company industrial reflector units, each with two 96-inch 200 ma. slimline lamps, are installed ten feet from the floor, and ten feet between rows. Two eight-foot long units are joined together to form a 16-foot long row on each side of the repair shop over the work areas. These continuous lines of light prevent annoying shadows and the spacings used result in an intensity of approximately 40 footcandles on a horizontal work plane about 30 inches from the floor. This intensity has proved quite satisfactory for the type of work done in this shop.

The architect for this new building was David Burke, of Syracuse, who cooperated with representatives of the lighting service department of Central New York Power Corporation in planning the lighting system. R. H. Clapp, Syracuse electrical contractor, did the electrical construction and installation work.

Specular Troffers Light Store

General lighting in Gilchrist Company's Framingham, Mass. store is provided by individual 2/40-watt lamp fluorescent recessed troffer units, Century Lighting Co. No. F-11. Spaced

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LOW BRIGHTNESS ***recessed Century Lighting troffers, each using 2/40-watt fluorescent lamps in specular Alzak reflectors, provide over 30 footcandles general illumination in Gilchrist Co. store, Framington.***

on ten-foot centers in rows located about six feet apart, these units produce approximately 30 footcandles.

Each troffer unit is equipped with two 40-watt lamps, and the light from each lamp is controlled by a separate specular Alzak reflector. Contour of the reflector is such that the light distribution is fairly concentrated, mainly below the 45-degree angle. Louvers installed flush with the bottom of the units eliminate glare from the lamps and spill light above the 45-degree zone (note light distribution on rear wall in illustration above).

Additional illumination is provided about the side walls by strip fluorescent lighting, recessed in top of wall cases.

Showcases are illuminated with Garcy nickel-silver showcase reflectors equipped with slimline fluorescent lamps which are operated at 300 ma. Additional light over the jewelry and cosmetic counters at the front of the store is provided by Century projector spot lamps equipped with fresnel lenses to give a 55 degree by 15 degree asymmetrical light distribution which confines the light to the counter tops.

The floor area of the store adjacent to the all-glass front is bathed with light by No. 337 Century spotlights, and closed back show windows are lighted by No. 500 Century fresnel lens spotlights.

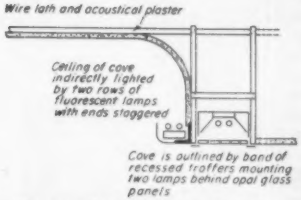
Barnes and Champney, Boston, were the architects for this store, and M. B. Foster, electrical contractor of Boston installed the lighting system and all electrical work.

BRIGHTEST LIGHTED RACE TRACK ***in the country is the new $800,000 Rosecroft Raceway at Oxon Hill, Maryland, which is ideal for television and enables grandstand spectators to see every detail from start to backstretch to finish. A total of 288 Type L-69 G. E. floodlights make the start and finish line as bright as the average office. Special dimming equipment permits truck lights to be lowered between races.***

Direct-Indirect Cove Creates Ceiling Pattern

The public area of the Chemical Bank and Trust Company, Rockefeller Center, New York City, is illuminated by a central ceiling cove measuring roughly 17 by 40 feet, located 18 feet, above the main floor level. The surface of the cove proper is indirectly illuminated by two rows of 3500 degree white fluorescent lamps, mounted end-to-end with staggered ends to minimize dark spots on the plaster cove area. Outlining this area, a secondary band of

DIRECT-INDIRECT COVE ***utilizes double row of fluorescent lamps to softly illuminate acoustical plaster in cove area proper, and secondary troffer installation mounting 2 rows of lamps behind Corning glass panels.***


Wire lath and acoustical plaster
Ceiling of cove indirectly lighted by two rows of fluorescent lamps with ends staggered
Cove is outlined by band of recessed troffers mounting two lamps behind opal glass panels

CROSS SECTION ***through cove indicates arrangement of two fluorescent installations directing light upwards toward acoustical plaster cove, and downwards through opal glass panels to floor area in public banking space.***

lighting is created by recessed troffers containing 2 lamps each, mounted above opal glass panels. The combination of these two treatments creates a novel effect.

Pollak and Grieve, consulting engineers for Rockefeller Center, worked in cooperation with architects Walker and Gillette to create the lighting plan. Fluorescent fixtures were by Lightolier, using glass panels manufactured by the Corning Glass Works. The electrical work was installed by Eastern States Electrical Contractors, Inc.

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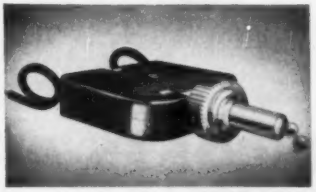
GUARANTEED *Unconditionally*

**Levolier Model 41 6 amp. "T" rated 125 volt switch is unconditionally guaranteed when used in lighting circuits. In case of failures a new Model 41 switch will be furnished without charge.*

When you install Levolier Model 41 switches in lighting circuits, you've installed the switch that will not fail. No kickbacks. No complaints. Just dependable, always-working performance. In fact, the patented Levolier action is so positive that the No. 41 is unconditionally guaranteed* NOT TO FAIL. Thousands of Model 41's, in use for years, prove this true.

The small, compact size of the Model 41 makes it ideal for use in modern lighting fixtures and canopies, as well as for FHP motor control.



A new addition to the Levolier line is the Model 71. This 6 amp. 125 volt, "T" rated switch is encased in a molded plastic case less than ½" thick. Pressure connected six inch wire leads provide fast, easy installation.

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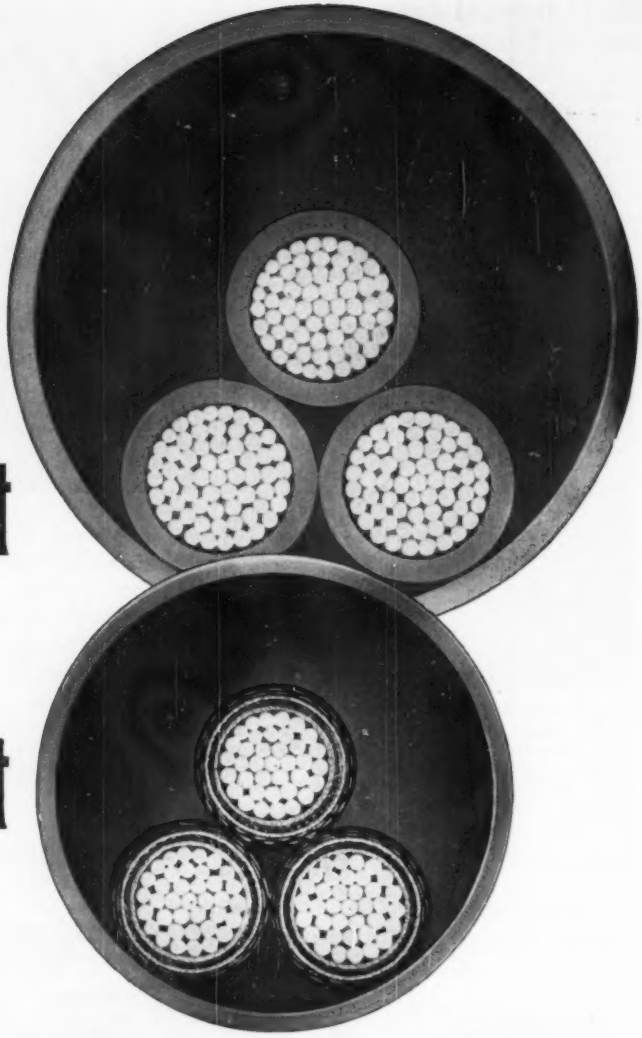

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In the News

NISA Holds Conference

Motor shop operators from New England, New York, New Jersey, Pennsylvania, the District of Columbia and scattered points across the country convened at Philadelphia on January 14th for the Annual Conference of the Northeastern Chapters of the National Industrial Service Association. Members and guests totaled more than 200.

The conference included a tour through Westinghouse's repair and maintenance motor department, thought-provoking technical sessions, and an entertainment program.

Opened by C. R. Durand, H. N. Crowder Jr. Co., Allentown, Pa., the afternoon technical session heard Samuel Heller of New York's Consolidated Electric Motor Company discuss the use of instruments in the shop, a talk in which he stressed unusual applications for common tools and devices. Howard Davies, Philadelphia, discussed primary capacitor motors. Hector Monroe, New England Machine and Electric Co., Pawtucket, R. I., explained the step-by-step processes and advantages resulting from the use of silicone varnishes. Ralph O. Kufen, O'Brien Machinery Co., Philadelphia, mentioned many interesting methods for testing and checking large-scale change-overs. And Richard Harris, Electric Equipment Co., Washington, D. C., discussed the "Guarantee of Electric Motor Repair and What it Means to Your Business."

A subject provoking wide interest and audience participation was an analysis of the Fair Labor Act as it pertains to the field of motor repair and activities of the NISA. Interpretations by business and government representatives were presented and the provisions of the act were explored.

Planned by the Quaker City Chapter (Philadelphia), the program was under the direction of an executive committee including W. J. Engel, T. B. McCabe Co.; A. Albertson, Sr., A. Albertson and Son; and J. B. Wagner, Wagner Electric Service. Chairmen for the field trip and the two sessions were William Engel, Joseph H. Previty, Penn Electric Motor Co. (Quaker president), and W. M. Hendrickson, W. M. Hendrickson and Co.

THE VOLLE BROTHERS, ***George H., and Fred G. of Springfield, Illinois, have built a spanking new building in which to operate their electrical contracting and motor repair business.***

NFEC Elects Sanders Chairman

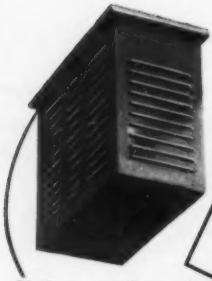
Dr. P. D. Sanders, Richmond, Va., Master of the Virginia State Grange and editor of the *Southern Planter* magazine, was elected 1950 chairman of the National Farm Electrification Conference at the December meeting of that group in Chicago. Dr. Sanders succeeds H. P. Rusk, dean and director of the University of Illinois College of Agriculture. Other officers elected include: Vice-chairman—Walter Deming, treasurer, Deming Pump Co., Salem, Ohio; secretary—Russell J. Gingles, manager, Farm Electrification Bureau, NEMA, New York City; treasurer—Karl H. Gorham, business manager, *Electricity on the Farm* magazine, New York City.

Named as regional vice-presidents were the following: Northeast—W. C. Krueger, extension specialist in agricultural engineering, Rutgers University, New Brunswick, N. J.; Northwest—C. J. Hurd, president, Hurd Farm Electric Supply Co., Spokane, Washington; Midwest—E. E. Slusher, president, Missouri Farm Bureau Federation, Jefferson City, Mo.; Southwest—Ross Mauney, agricultural engineer, Arkansas Power & Light Co., Pine Bluff, Ark.; Southeast—C. E. Seitz, head of agricultural engineering department, Virginia Polytechnic Institute, Blacksburg, Virginia.

In his keynote address at the Fourth Annual National Farm Electrification Conference, Dr. Sanders told the delegates that "the mechanization and electrification of American agriculture represents a backlog of business which is big enough to keep our economic machine running full blast for years to come." Although last year the average farm customer used 1,997 kwhrs. of electricity compared to 1,563 for his "city cousin", the farmer has not yet adapted it to the extent it is being used in industry, Sanders added. The great job that lies ahead for the electrical industry is research and education—entailing the development of electrical appliances adaptable to agriculture and an educational program to sell the former on their uses, he concluded.

Dean H. P. Rusk concurred with Dr. Sanders' views. Noting that 60 percent of the farm chores are still done the hard way, Rusk urged that better and cheaper ways be developed to do them; stated that industry should employ and give more support to the work of more men who know agriculture and farm life and who have faith in the future of electricity on the farm. Although more than 95 percent of America's farms today have electricity, many have wiring inadequate to serve all the appliances now coming on the market, he added, urging immediate concentration on a planning and replanning job on the farm level and also on the part of the public utilities and co-ops so that rural users of electricity will be assured continuity of service

PRESIDENT OF ***the Illinois Electrical Contractors Association (Illinois Chapter, NECA) is W. Glenn Durham (left) of Springfield. Lyle Foster, Peoria contractor and a past-president of the association represents the group on the NECA Board of Governors.***



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Platform- or wall-mounted air-cooled transformer. 50 KVA, three-phase, 480 to 120/208 Y volts.

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Standard's dry type load center transformers assure correct voltages at point-of-use. Installations are easily made and can be quickly relocated to conform to changing departmental requirements. Consult your Standard representative today. He can show you how Standard transformers save you money by assuring top performance from your equipment.

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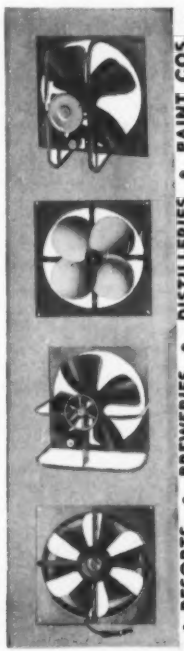

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THERE IS YEAR ROUND *Fan Business* FOR THE ALERT DEALER

There are many types of businesses that require year round ventilating equipment . . . businesses that operate under conditions of extreme heat, or penetrating and pungent odors.

These companies offer real opportunities to pick up additional business.

"FRIGID" has the complete line of ventilating equipment to meet the needs and demands of these companies . . . exhaust fans, blowers, spray booth fans, attic fans, etc. . . .

Get your share of these "extra" profits . . . check on your prospects today.

See your electrical dealer

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and adequate capacity for their future needs.

Sales representatives should approach the farmer as an individual and not as a cold market statistic, cautioned A. M. Young, Chicago, member of the Sales Analysis Institute. One of the greatest needs in the farm market is information concerning new, as well as old, types of equipment, processes and methods, he stated, adding that proper servicing of equipment is one of the key steps in the initial purchase and ultimate use of equipment.

The urgent need for *planning* on the part of farm management, the farm family, industry and agriculture, and all associated with the farm market, was explored at the conference by leaders of agricultural educational groups and farm equipment manufacturers and suppliers. Progressive research and means of bringing results of such research to the attention of the farmer and ultimate use on the farm were among the subjects discussed.

Notes About NISA Activities

The services offered motor repair shops and the membership drives conducted by the National Industrial Service Association are beginning to pay dividends in the form of new group organizations. Among the latest to

RALPH BARKER, ***superintendent of the motor repair shop for the Steele Electric Equipment Company at Niagara Falls, personally checks all orders connected with the company's pick-up, repair, exchange and delivery activities.***

SYLVANIA PRESENTS...

THE NEWEST IN CLASSROOM LIGHTING...

FOR THE LAST WORD IN CLASSROOM ARRANGEMENT

The familiar rows of desks have vanished in the Bowditch Model Classroom in Salem, Mass. Instead, the desks are arranged in groups of six, facing in three different directions.

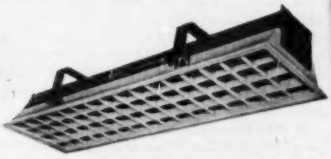
The lighting problem was solved by the use of Sylvania CL-242 Fluorescent Fixtures, installed in continuous rows by Wilson and Robinson, electrical contractors.

The result is a lighting system that combines ample intensity in all parts of the room with the low surface brightness essential for the protection of children's eyes.

Whatever the lighting requirements of a job, contractors find in the complete Sylvania Fluorescent Line exactly the fixtures they need!

Sylvania's Popular "Instant Start" CL-283—A new fixture, perfect for unbroken lines of light. Utilizes two Sylvania 8-foot, 75-watt Instant-Start Slimline Lamps. Easy to install and service.

Sylvania's Popular "Standard Start" CL-242—A low-cost, carefully engineered unit ideal for lighting classrooms and school offices. Uses two Sylvania 4-foot, 40-watt Triple-Life lamps.



Sylvania's Modern TROFFERS—Where recessed lighting is desired, use the Sylvania CST Series Troffers—available in one-, two- and three-lamp (Sylvania Triple-Life) units.

All the facts you'll want to know about planning school lighting jobs!

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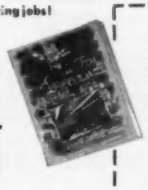
FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES, SIGN TUBING; LIGHT BULBS; PHOTOLAMPS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES



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DO BOTH WITH

New 250-watt
WELLER GUN

You'll save on tools and time with the new Weller Soldering Gun WD-250. Whether the job is rugged or delicate, your Weller Gun does it with the same ease and efficiency. Chisel-shaped RIGID-TIP provides more soldering area for faster heat transfer. New "over-and-under" terminal design gives bracing action to tip. Your Weller Gun is light-weight and compact, gets into the tightest spots.

Weller Guns actually pay for themselves in a few months. Fast 5-second heating saves time on every job. Trigger-switch control saves power—no need to unplug gun between jobs. Prefocused spotlight and longer length mean easy soldering, even when the job's buried deep. No other soldering tool gives you so many time-and-money-saving features. Order your new 250-watt Weller Gun from your distributor today, or write for bulletin direct.

SOLDERING GUIDE Get your copy of "SOLDERING TIPS"—new fully illustrated 20 page booklet of practical soldering suggestions. Price 10c at your distributor's or order direct.

WELLER MANUFACTURING COMPANY
815 Packer Street, Easton, Pa.

join the NISA ranks is the newly organized *Los Angeles Chapter*. Elected to office for the coming year were: Chairman—Wm. C. Hill, Hill Electric Co.; vice-chairman—Ray Smallcomb, Smallcomb Electric Co.; secretary-treasurer—W. M. Hogue, Larson-Hogue Electric Company.

The *North Central Chapter* was recently organized in Minneapolis by a group of motor shops from Minnesota and the Dakotas. Guiding the growth of this chapter are the following: President—Earl H. Wheat, Wheat's Electric Motor Repair, Watertown, South Dakota; vice president—C. H. Stocking, Stocking Electric and Machinery Sales Service, Hutchinson, Minn.; secretary-treasurer—George P. Svendsen, Boustead Electric & Mfg. Co., Minneapolis.

In Seattle, Washington, the *Puget Sound Chapter* was recently formed. Active in the chapter organization and promotion are: Chairman—Carl Lundberg, Cascade Machinery Co.; vice-chairman—Mr. Fellstrom, Fellstrom Electric Works; secretary-treasurer—Harry G. Brown, Seattle Electric Works. All officers are from Seattle.

At Buffalo, New York, the *Niagara Chapter* was founded. Guiding the activities of this new group are: President—Harry Z. Lang, Lang Electric Co.; secretary—Norman Robinson, E. J. Robinson Company, both of Buffalo.

Southeastern Chapter—Officers chosen at a two-day meeting of this established chapter include: President—A. Coleman Waldrop, Wingfield & Hundley, Richmond, Va.; vice-president—H. Hall Grey, Southern Electric Service, Greenville, S. C.; secretary-treasurer—E. Harold Laycock, Laycock Armature Works, Tampa, Florida.

John Wise Heads IAEI

Newly elected president of the International Association of Electrical Inspectors is John E. Wise, electrical engineer for the State of Wisconsin Industrial Commission at Madison.

Other officers chosen to serve with Wise for the 1950 term are: First vice-president—Arthur C. Veit, electrical inspector, County of Los Angeles, Los Angeles, California; second vice-president—Chester M. Kirsop, chief electrical inspector, Olympia, Washington; third vice-president—A. W. Stall, chief electrical inspector, Jacksonville, Florida; fourth vice-president—B. A. McDonald, electrical superintendent, New York Board of Fire Underwriters, Rochester, N. Y. Charles L. Smith, Chicago, is the secretary-treasurer of the association.

"Know-How"

means profits for electrical contractors, especially when they know how fast and easily they can cut and drill thru concrete and masonry with dependable—

SYNTRON

ELECTRIC HAMMERS

These dynamic little "earners" actually pay for themselves at the job-tried rate of $4.00 every hour.

Producing 3600 hard blows per minute, Syntron Hammers are built to "take it" on job after job. 50,000 in use have proven this.

They are available in five different models—all small in size yet big in power.

Write for Literature

SYNTRON CO.

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NISA Convention Committee Appointed

The annual convention of the National Industrial Service Association will be held in Boston at the Hotel Statler on June 4 to 7.

Fred Ferris of the Northeastern Electric Company has been appointed convention committee chairman and Alfred Elson of the New England Machinery & Electric Company, as co-chairman.

Other members of the committee are Program: A. Elson, P. Keating, E. Kolhonen; Registration, B. L. Whittemore, A. S. Tracy, P. Stultz and P. Leicht; Entertainment, D. Sandman, C. Dulsen, L. F. Guerrette; Reception, H. Bedig, G. Williams, R. Brown, W. White, S. Schaffer; Transportation, H. Caddy, A. Glines, J. Piela and Publicity, J. J. Reddington and J. Connors.

Grant Now In Miami

H. E. Grant, Tennessee Electric Motor Service, Nashville, has again expanded his motor repair activities by purchasing the Alldritt Electric Motor Company from Larry Alldritt of Miami, Florida. Grant will continue to operate the company under the old name.

Book Reviews

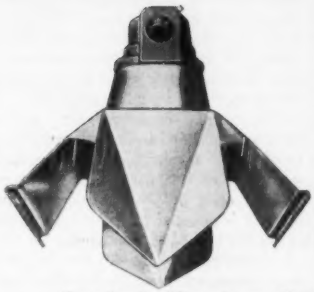
Lighting for Sports and Recreation

A new and comprehensive 37-page book on the subject of "Lighting for Sports and Recreation" has been issued by the Lamp Department of the General Electric Company, Nela Park, Cleveland, Ohio. It was written and prepared by Kirk M. Reid and A. F. Nies, G-E illuminating engineers.

Interest in sports and recreation has pyramided during the last few years. This interest has had its parallel in night illumination for sports, especially during the war years when war workers could find time for sports and recreation in the main only at night or in the late evening hours. This interest has maintained post-war, so that this new treatise on sports lighting is most timely.

Recommended practices in the lighting of sports and recreation areas have been generally standardized, based on studies by such groups as the Sports and Recreational Area Lighting Committee of the Illuminating Engineering

"YOU CAN PROFITABLY USE QUAD LIGHTING UNITS AISLE STOCK REFLECTORS"



Here is the Aisle Stock Reflector Unit to suggest every time you have a stock room installation. It is the unit that will bring business your way because it does the right kind of job in illuminating shelving, bins, or stacks of cartons piled on either side of narrow aisles.

This unique and practical type of reflector affords a scientifically arranged reflecting surface. As a result, light reaches from upper tiers of shelving to floor level. There is an effective eye shield also that is appreciated by the stock room employees and that facilitates work. This feature is accomplished because of a lower light cut-off angle at each end of the reflector.

These units are accurately formed of heavy gauge steel, porcelain enameled with ground coat and two white coats inside and outside. Four interchangeable styles of Q-D socket-fittings are available.

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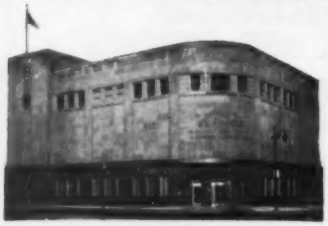
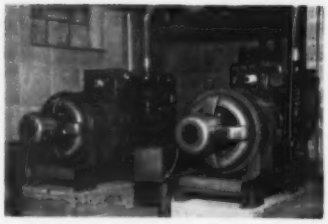
Another modern telephone exchange



is sure of continuous power



with "U.S." stand-by Electric Plants

IN telephone service, stand-by power is chosen for its *dependability*. That's why more and more telephone companies are turning to "U.S." . . . that's why "U.S." was selected by the Indiana Associated Telephone Corporation for this beautiful new building in Elkhart.

In any business, wherever stand-by power is needed, it will pay you to get the facts about "U.S." units. Complete line includes units from 300 watts to 175 KW. Diesel, gasoline or gas.

UNITED STATES MOTORS CORP.
580 Nebraska St., Oshkosh, Wis.

Export Dept., 212 E. Washington Ave., Madison 3, Wisconsin, U.S.A.

US ELECTRIC-PLANTS

Society and the Floodlighting Section of the National Electrical Manufacturers Association, in which attention has been given to the lighting requirements of both players and spectators. This new bulletin comprises a guide to these current recommended practices. It is in three parts.

Part I discusses lighting for such sports as baseball, football, softball, archery, badminton, basketball, bathing beaches, bowling on the green, outdoor boxing and wrestling, croquet and roque, golf driving ranges, horseshoe courts, midget auto racing, shuffleboard, skeet, swimming pools, tennis and trap shooting.

Part II describes recommended lighting for billiards, bowling, hockey, indoor boxing and wrestling, rifle and pistol ranges, squash and handball courts, roller skating, and table tennis.

Part III concerns the operation and care of floodlights and equipment.

Photographs, tables and layout drawings are used throughout which contribute to the practical value of this handbook on sports lighting. The booklet is 8½ in. by 11 in., and is available at a price of 45 cents.

Steel Electrical Raceways

Dealing primarily with design and installation problems encountered in the use of rigid steel conduit and electrical metallic tubing, "Steel Electrical Raceways" is a 131 page reference manual and guide. It should be of interest to design engineers, electrical inspectors and all electrical construction apprentices, either in formal trade school study or in active training.

The manual contains much useful technical data and information relating to electrical conduits, its function and place in wiring systems, and other fundamentals of wiring design. One chapter is devoted to sixteen pertinent reference tables, with examples for use of the tables and data. Another chapter is a reference guide to the National Electrical Code, while other chapters treat such subjects as "Dimensions and Types of Steel Conduits and Fittings", "Tools and Equipment for Installing Conduit", and "Installation Hints and Practices".

The manual is fully illustrated with simple drawings which feature one point at a time, making it easy to understand and follow.

The manual is a handy pocket size, 5½ in. by 8½ in., containing 131 pages plus several blank pages for notes. It is available from American Iron and Steel Institute, 350 Fifth Avenue, New York, 1, N. Y. Price $1.00.

LOOK!

Paragon MODEL 301 TIME SWITCHES Only $11.50 List and with LOWEST NET PRICES TO CONTRACTORS

Paragon top quality, straight "ON and OFF" Time Switches are accurate and dependable for controlling stokers, burners, valves, motors and other equipment where two or four operations per day are required. Industrial type, self-starting motor, 115 volt, 60-cycle, 30 Amp., 3000 Watt capacity. Shock-proof terminal back. SPST and DPST; (230V, or 24V, at slightly higher cost).

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AMERICA'S FOREMOST EXCLUSIVE MANUFACTURER OF TIME CONTROL SWITCHES FOR ALL USES

WORTH ASKING FOR by name...

Reliability in every splice

"The tape with the yellow core"

made by OKONITE

Sold Only Through Recognized Wholesalers

Ask for them by name... Panther and Dragon friction and rubber tapes

Dates Ahead

North Central Electrical Industries—All-Industry Convention and Trade Show, St. Paul Hotel, St. Paul, Minn., March 5-9.
International Municipal Signal Assn.—55th Annual convention, Hotel Commodore, New York, N. Y., Sept. 18-21.
Canadian Electrical Manufacturers Assn.—Annual meeting, General Brock Hotel, Niagara Falls, Ont., Sept. 27-29.
National Electrical Manufacturers Association—Chalfonte-Haddon Hall, Atlantic City, N. J., Nov. 13-16.
National Electrical Manufacturers Association—Edgewater Beach Hotel, Chicago, Ill., March 13-16.
American Society of Tool Engineers—Industrial exposition, Convention Hall and Commercial Museum, Philadelphia, Pa., April 10-14.
Chamber of Commerce—38th Annual meeting, Washington, D. C., May 1-4.
National Fire Protection Association—54th Annual Meeting, Haddon Hall, Atlantic City, N. J., May 15-18.
National Industrial Service Assn.—Annual meeting, Boston, Mass., June 5-7.
National Association of Electrical Distributors—Annual convention, Atlantic City, N. J., June 12-16.

Manufacturers News

GRAYBAR CHANGES

R. W. Kimberlin has been appointed San Francisco district manager for the Graybar Electric Company. He has assumed the duties vacated by J. P. Carson who retired on January 1. Mr. Kimberlin comes to his new post from St. Louis where he also was district manager.

C. S. Powell has been named St. Louis district manager to succeed Mr. Kimberlin.

GUTH REPRESENTATIVES

The Edwin F. Guth Company has announced the appointment of Frank Moos as representative in the Maryland, Virginia and District of Columbia area.

Rene M. Moisson of Cambridge, Mass., has been named representative in the New England area. Mr. Moisson will cover Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island.

WESTINGHOUSE APPOINTMENTS

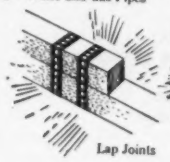
The appointment of F. P. Taugher as manager of engineering for the Westinghouse Electric Corporation's industrial control division, Buffalo, N. Y., has been announced.

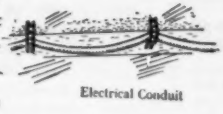
M. L. Gardner has been named engineering and service manager of the New England district with headquarters in Boston, Mass. He succeeds Mr. Taugher.

A. A. Johnson has been appointed manager of central station engineering in the industry engineering department of Westinghouse. He succeeds Dr. Charles F. Wanger who was recently named consulting engineer for the company

Heating Equipment

Water and Gas Pipes


Lap Joints


Electrical Conduit

1001 USES ABOUT THE JOB

Everywhere you turn there's a job for Paine Hanger Iron that will help you to conserve labor and reduce your costs. This simple, yet amazingly versatile product can be bent or twisted to fit your exact needs. It can be used for hanging pipe, cable, conduit and numerous other items. It can be used for strengthening construction. Hanger Iron may be installed with nuts and bolts, screws or nails. It is ¾" wide and 20 gauge in 10' zinc-plated coils. Perforated with holes for ¼" bolts on ½" centers. Reduce your construction costs—ask for Paine Coiled Hanger Iron from your supplier today.

THE PAINE COMPANY

2961 Carroll Avenue **Chicago 12, Illinois**

OTHER PAINE PRODUCTS
BUILDERS SPECIALTIES

Spring Wing Toggle Bolts
Expansion Anchors
"Sudden Depth" Drills
Wood Screw Anchors
Pipe and Conduit Clamps and Straps
Hanger Iron; perforated
Expansion Shells
Star Drills
Malleable Shields
Special Hanging and Fastening Devices

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WHEN YOU USE PLIERS... *You need* CHANNELLOCK

Easy to remember... CHANNELLOCK

CHANNELLOCK • CHANNELLOCK • CHANNELLOCK • CHANNELLOCK

No matter what your work . . . plumbing, electrical, automotive, aviation, battery or ignition — there is a Channellock plier designed specifically for your job. If you use pliers . . . you need Channellock.

CHANNELLOCK

The exclusive tongue and groove joint gives you these "plus" features: Greater Strength, Longer Wearing, Self-Cleaning, Closely Spaced Adjustments, Visible Adjustments, No Wear on Joint Bolt.

Send for Catalog C-6 today

CHAMPION DEARMENT TOOL CO
MEADVILLE • PA.

Only Champion DeArment makes CHAN NEL LOCK

John E. Payne has been named manager of the Westinghouse Central District. He will have complete supervision of the apparatus business in the Pittsburgh, Cleveland, Detroit and Cincinnati areas and will make his headquarters in Pittsburgh.

The appointment of J. P. Coughlin as manager of field sales, welding department, Westinghouse, Buffalo, N. Y., has been announced.

WESTON APPOINTMENT

Appointment of Anthony H. Lamb as vice president of the Weston Electrical Instrument Corporation, Newark, N. J., has been announced.

Mr. Lamb, employed by the Weston corporation since 1924, will assume responsibility for the operation of the

A. H. LAMB

Tagliabue Division of the company. The C. J. Tagliabue Corporation was purchased by Weston in 1948 and at that time Mr. Lamb was appointed assistant chief engineer of the Weston organization and acting chief engineer of the C. J. Tagliabue Corporation.

GENERAL ELECTRIC CHANGES

Seven executives of the General Electric Company's apparatus department have been named to new positions. They are:

Neil Currie, Jr., from manager of manufacturing to administrative assistant to the general manager

Ernest E. Johnson, from manager of engineering to manager of engineering, large apparatus divisions.

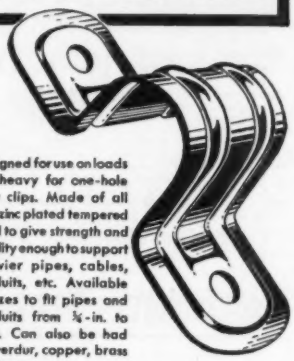
Carl A. Salmonsen, from manager, aircraft gas turbine divisions, to manager of manufacturing, large apparatus divisions.

Byron A. Case, from assistant to manager of engineering, to manager of engineering, small apparatus divisions.

Frank T. Lewis, from manager of manufacturing, aeronautic and ordnance systems divisions, to manager of manufacturing, small apparatus divisions.

Clarence H. Linder, from assistant manager of manufacturing to assistant to the general manager.

MINERALLAC 2-HOLE
PIPE STRAPS
For Heavier Loads!



Designed for use on loads too heavy for one-hole Jiffy clips. Made of all new zinc plated tempered steel to give strength and rigidity enough to support heavier pipes, cables, conduits, etc. Available in sizes to fit pipes and conduits from ¾-in. to 1-in. Can also be had in Everdur, copper, brass or aluminum.

Send for literature and prices

Specify MINERALLAC HANGERS, CLIPS, STRAPS, BUSHINGS

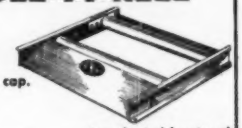
MINERALLAC ELECTRIC COMPANY
23 N. Peoria St., Chicago 7, Illinois

MINERALLAC

Simple as A B C

Handle heavy reels easily and safely; remove wire or cable from top or bottom, front or back of reel with

ROLL-A-REEL



Style A:
2,000 lbs. cap.
37.50

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F.O.B. Cincinnati

low slanted front and positive front lock insure quick loading or unloading.

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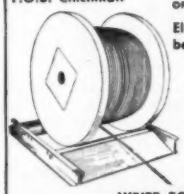

Carried easily to reels, job or storage.

Sold through wholesalers only.

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ROLL-A-REEL
327 WEST FOURTH STREET
CINCINNATI 2 OHIO

C. W. LaPierre, from assistant manager, aircraft gas turbine divisions, to manager aircraft gas turbine divisions.

The appointment of Frank M. Lewis of Mt. Lebanon, Pa., as district representative for the Pittsburgh trading area of G. E.'s construction materials department, has been announced. He will make his headquarters in the Oliver Building, Pittsburgh.

Expansion of the G. E.'s transformer manufacturing and testing facilities at Pittsfield, Mass., which will more than double the company's power transformer production capacity, has been announced.

Leo F. Brown has been appointed plant manager of the air conditioning equipment plant of G. E.'s air conditioning department.

Edward D. Kemble has been named plant manager of the automatic heating division of the air conditioning department, Bloomfield, N. J.

AMERICAN COACH APPOINTMENT

The American Coach & Body Company, Cleveland, Ohio, has announced the appointment of Fred C. Hall as director of sales, succeeding Clarence G. Wood.

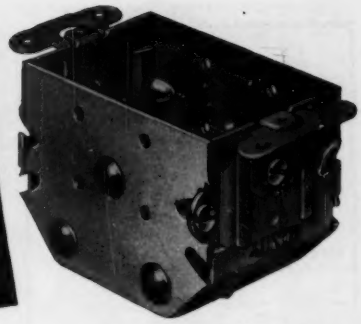
F. C. HALL

Mr. Hall has been a member of the American organization since 1936. He has concentrated on sales work and has represented the company in the western half of the United States. In 1946, he was chosen to open the company's new California division at Oakland. As general manager, he has been the active executive officer of the division, until his recent recall to Cleveland as director of sales for the entire company.

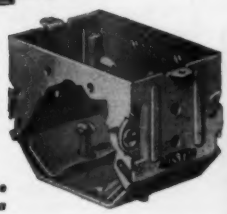
PYRAMID INSTRUMENT REPRESENTATIVES

As part of an over-all plan of expanding sales, Pyramid Instrument Company, New York City, has appointed four new sales representatives covering the Middle West, the extreme Northwest, and Florida. The newly appointed representatives and their respective territories are:

AUSTIN'S *Improved* LR BOX



Nails to Studding Evenly, Accurately, in a Matter of Seconds . . .



For use in Old or New Wiring

Write for descriptive price sheet No. A-1-a

Faster Installation!
Nail holes in box sides provide fast, easy installation. Saves money by eliminating bracket. Nail heads driven in tight—box is never out of line.

Perfect Alignment!
3 nubs facing outward on each side of box prevent box from tilting. First nub is 7/8" from front of box to permit adjustment for wallboard or plaster.

The M. B. Austin Company
NORTHBROOK, ILLINOIS

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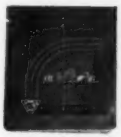
EXPLOSION-PROOF . . .
DUST-TIGHT . . .

For safe and correct lighting in hazardous areas, count on R & S Lighting Fixtures to stand up better . . . to deliver long-term, top performance . . . because of illumination engineering ingenuity and over forty years' manufacturing know-how.



Write for new catalog H-47.4

Scientific design with high reflection factor provides maximum, safe, controlled lighting . . . maintenance-free. Standardized base common to all sizes. Interchangeable reflector globe assemblies of various capacities. Simplified mounting without disturbing electrical connections; with a variety of conduit arrangements in one standard base. Underwriters' laboratories approved.

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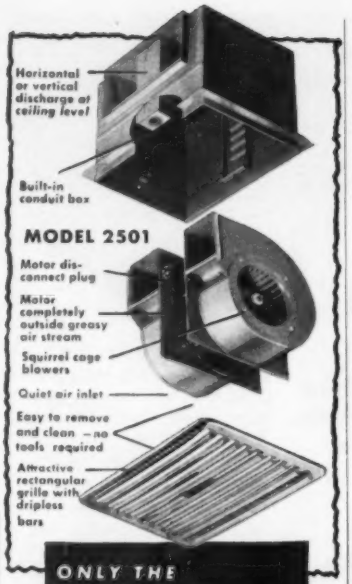
SALES OFFICES IN PRINCIPAL CITIES

SINCE 1902

RUSSELL & STOLL COMPANY, INC.
Precision-Built Electrical Equipment
125 BARCLAY STREET, NEW YORK 7, N. Y.


Horizontal or vertical discharge at ceiling level
Built-in conduit box
MODEL 2501
Motor disconnect plug
Motor completely outside greasy air stream
Squirrel cage blowers
Quiet air inlet
Easy to remove and clean — no tools required
Attractive rectangular grille with dripless bars

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TRADE-WIND
CLIPPER
HAS ALL THESE
ADVANTAGES

FOR the *best* method of ventilating kitchens, bathrooms, laundries, dens or other small rooms specify and install the Trade-Wind Clipper. This proven ventilator is *the only small room unit* that gives the home owner every worthwhile advantage.

Squirrel cage blowers, accepted and used in air conditioning systems and for forced air heating, are used exclusively in the Trade-Wind Clipper. This forced air discharge, located at the ceiling, traps all unwanted air and expels it instantly. Trade-Wind also has located the motor completely outside the greasy air stream. The motor stays clean indefinitely—requires far less service—and is guaranteed for 5 years. No other small room ventilator combines all these outstanding advantages. In addition, Trade-Wind Clippers are easy to install—they are competitively priced*—and they make every new owner another salesman for the Trade-Wind line.

Get the complete story from your local supply source, or mail the coupon today.

*Important price reduction has just been made on Model 2501.

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TRADE-WIND MOTORFANS, INC.
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Please send me the complete story on the Trade-Wind Ceiling Ventilator.

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Address_____

Koehler-Pasmore Company, Detroit, Mich., the lower peninsula of Michigan and the city of Toledo, Ohio.

Engineering Products, Indianapolis, Ind., the states of Indiana, Kentucky, Southern Illinois, and Southern Ohio.

Northwestern Agencies, Seattle, Wash., the states of Washington, Oregon, Idaho, Montana, British Columbia and Alaska.

Industrial Specialties Sales, Tampa, covering the state of Florida.

•

Leader Electric Company, Chicago, has announced the appointment of J. L. Kilpatrick as Eastern sales manager. Mr. Kilpatrick will make his headquarters in New York City and will supervise the sales-engineering activities of Leader representatives throughout the Eastern states. Since the war he has been vice president in charge of sales for Silvray.

•

General Controls, Glendale, Calif., has opened new factory branch office facilities in Minneapolis, Buffalo and Baltimore. Named as branch managers in these offices are R. Roger Rosell, Jr., Minneapolis; Paul A. Palmgren, Buffalo and Rred H. Angier at Baltimore.

•

Helwig Company, Milwaukee, Wisc., has named R. W. Fletcher as its San Francisco representative.

•

The appointment of the Busch-Hodges Company to represent **Curtis Lighting, Inc.,** in the Pittsburgh area has been announced.

•

The Electric Products Company, Cleveland, Ohio, has appointed the William E. Brice Company, Houston, Texas as district representative for Southern Texas.

•

Insulation Manufacturers Corporation of Chicago has opened a new office in Pittsburgh, Pa., in the Oliver Building, 535 Smithfield Street. William A. Carlstrom, formerly connected with the company's Detroit branch, is manager of the new office.

•

Ward Leonard Electric Co., Mount Vernon, N. Y., has opened a new branch office at 4030 Chouteau Avenue, St. Louis, Mo. Charles B. Durling, Jr. is district manager.

•

Burndy Canada Ltd., a subsidiary of the **Burndy Engineering Co., Inc.,** New York, has opened a new factory at 381 Greenwood Ave., Toronto.

ELECTRICAL MACHINERY

1. New 3rd Edition. Packed with up-to-date help explaining the installation, operation and maintenance of electrical machinery—from the fundamentals of magnetism, electro-magnets and electrical circuits, to the latest material on electron tubes and circuits in which they are used. Shows how electrical instruments are built . . . covers meters and measurement techniques, a-c and d-c motors, etc. **By F. A. Annett, Power, 458 pages, $3.75.**

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3. An encyclopedia of facts and figures, definitions, conversion factors, physical and mathematical principles, accepted formulas and experimental data. Over 2300 pages give you the combined experience of experts in the field. Includes important new developments . . . radar and associated microwave techniques . . . magnetic materials . . . servomechanisms and rotating regulators . . . induction and dielectric heating . . . airplane power distribution . . . nuclear energy . . . etc. **A. E. Knowlton, Editor-in-Chief, 8th Edition, 2311 pages, $12.00.**

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4. This manual gives information you need to estimate the cost of an electrical construction job . . . quickly and accurately. Covers everything from the selection and training of electrical estimators and the proper use of estimating tools, to the cost of preliminary estimates and the preparation of final bid sheets. Discusses estimating forms, tools, the study of plans and specifications, listing and checking material quantities, checking completed estimates, etc. Sample estimates of actual construction costs make this book a "must" for everyone concerned with estimating problems. **By Ray Ashley, Electrical Eng'r., 387 pages, $6.50.**

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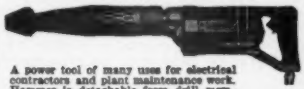

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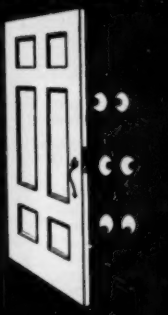

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Advertising In This Issue

Accurate Mfg. Co. 111
Adam Electric Co., Frank 29
Advertising Council Inc., The .. 42
Allis-Chalmers Mfg. Co. 5, 13, 15
All-Steel Equipment, Inc. 25
Alter Co., The Harry 137
Anaconda Wire & Cable Co. 46
Appleton Electric Co. 2
Arro Expansion Bolt Co. 124
Arrow-Hart & Hegeman Electric Co., The 90, 99, 100
Austin Co., The M. B. 104, 135

Bakelite Division, Union Carbide & Carbon Corp. 68
Benjamin Electric Mfg. Co. 27
Blackhawk Mfg. Co. 87
Briegel Method Tool Co. 10
Buffalo Forge Co. 94
BullDog Electric Products Co. 17
Bussmann Mfg. Co. 18, 19

Century Electric Co. 114
Certified Ballast Mfrs. 20
Champion DeArment Tool Co. 134
Circulators & Devices Mfg. Corp. 128
Corning Glass Works 28
Couch Co., Inc., S. H. 103
Crescent Ins. Wire & Cable Co. 38
Curtis Lighting, Inc. 22
Cutler-Hammer, Inc. 71

Day-Brite Lighting, Inc. 102
Dossert Mfg. Corp. 110

Economy Fuse & Mfg. Co. 24
Efficiency Electric & Mfg. Co. .. 138
Electrical Facilities, Inc. 98

Fasco Industries, Inc. 108
Federal Electric Products Co. 43
Fullman Mfg. Co. 72

General Electric Co. (Apparatus Dept.) ..... Second Cover, 70
General Electric Co. (Chemical Dept.) 26
General Electric Co. (Construction Materials Dept.) Fourth Cover, 80
General Switch Corp. 14
Graybar Electric Co., Inc. 48
Greenlee Tool Co. 91
Guth Co., The Edwin F. 66, 67

Hazard Insulated Wire Works. 77, 132
Heinemann Electric Co. 118

Ideal Industries, Inc. 31
Illinois Electric Porcelain Co. 76
Industrial Electronics Corp. 104
International Register Co. 8
Irvington Varnish & Ins. Co. 86

Jefferson Electric Co. 78
Jenkins Bros. 41

Kato Engineering Co. 137
Koch Sons, Inc., George 96

Leader Electric Co. 122
Linde Air Prod. Co., The (Unit of Union Carbide & Carbon Corp.) 120
Litecontrol Corp. 39
Long Co., W. H. 138

McGill Mfg. Co. 125
McGraw-Hill Book Co. 136, 138
McGraw-Hill Pre-Filed Electrical Catalogs 137
Midwest Electric Mfg. Co. 84
Minerallac Electric Co. 134
Minnesota Mining & Mfg. Co. 97
Mitchell Mfg. Co. 93
Murray Mfg. Corp. 1

National Electric Prod. Corp. 65
National Varnished Prod. Corp., The 9

Okonite Co., The 77, 132
Onan & Sons, Inc., D. W. 138
Oster Mfg. Co., The 92

Paine Company 133
Paragon Electric Co. 132
Post-Glover Electric Co., The 40
Pyle-National Co., The 112

Quadrangle Mfg. Co. 131

Republic Steel Corp. 6, 7
Ridge Tool Co. 79
Rockbestos Products Corp. 126
Roebling's Sons Co., John A. 11
Rohm & Haas Co. 33
Roll-A-Reel Co. 134
Rome Cable Corp. 116
Russell & Stoll Co., Inc. 120, 135

Sangamo Electric Co. 30
Signal Electric Mfg. Co. 73
Simplet Electric Co. 96
Simplex Wire & Cable Co. 44
Slater Electric & Mfg. Co., Inc. .. 88
Snap-on Tools Corp. 105
Spang-Chalfant (Div. of The National Supply Co.) 74
Square D Co. ..... Third Cover
Standard Transformer Co. 128
Steel City Electric Co. 37
Steel & Tubes Division 6, 7
Stemco Corp. 95
Sticht Co., Inc., Herman H. 137
Sylvania Electric Prod., Inc. 129
Syntron Company 130

Tal Bender, Inc. 102
Tomic Sales & Engineering Co. .. 32
Topflight Tape Co. 137
Trade-Wind Motorfans, Inc. 136
Triangle Conduit & Cable Co., Inc. 109
Trumbull Electric Mfg. Co. 106

Union Carbide & Carbon Corp. 68, 120
Unistrut Products Co. 23
United States Motors Corp. 132

Wagner Electric Corp. 16
Wakefield Brass Co., The F. W. 36
Weller Mfg. Co. 130
Western Insulated Wire Co. 110, 137
Westinghouse Electric Corp. (Lamp Div.) 12
Westinghouse Electric Corp. (Lighting Div.) 121
Westinghouse Electric Corp. (Pittsburgh) 21, 34, 35
Where To Buy 137
Wiremold Company, The 89
Wodack Electric Tool Corp. 137

Youngstown Sheet & Tube Co. .. 4

■

SEARCHLIGHT SECTION

(Classified Advertising)

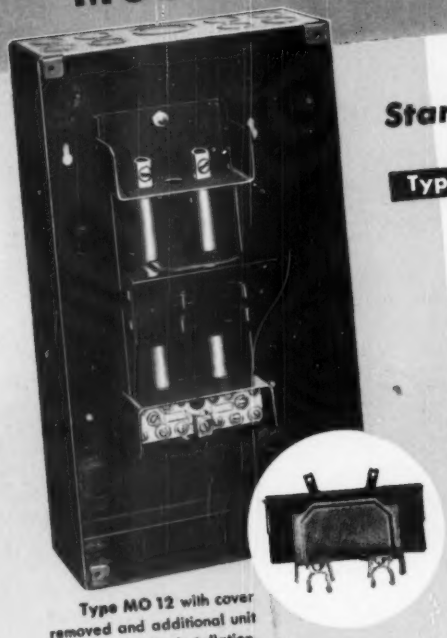
EMPLOYMENT
Positions Vacant 139
Selling Opportunities Offered 139

EDUCATIONAL
Books 139

EQUIPMENT
(Used or Surplus New) For Sale 139

WANTED
Equipment 139

NOW... "plug-in" type MULTI-BREAKER LOAD CENTERS



Type MO 12 with cover removed and additional unit ready for installation.

Start with 4 . . . Add More

Type MO 12 consists of box with bus structure and one 4-circuit "plug-in" unit in place. One or two additional 2 or 4 circuit units can be plugged on the bus structure—giving 6, 8, 10 or 12 circuits as required.

Plug-in Units are available in ratings of 15, 20, 30, 40 and 50 amperes, 120/240 volts A.C. Handle ties permit converting of adjacent poles of similar capacity on each breaker unit into double-pole, individual trip circuits. Breaker units are identical with those used in MO Panelette and NMO Panelboard. They are *individually packaged* but can be added to basic device carton, after selection.

3ø, 4 wire arrangement is also available.

Flush or Surface mounting. Either cover can be added to basic device carton, after selection.

Type MO 20 with cover on and all five 4-circuit units installed.

Type MO 20 is similar to type MO 12 but it provides space for as many as four additional 2 or 4 circuit "plug-in" units—giving 6, 8, 10, 12, 14, 16, 18 or 20 circuits as required.

Write for Bulletin SA 590 . . . it gives the complete story. Address Square D Company, 6060 Rivard St., Detroit 11, Michigan.

Coilless

THERMAL-MAGNETIC BREAKER UNITS GIVE 2-WAY PROTECTION

Thermal element responds to heating effects of both load current and surrounding atmosphere. *Total temperature* is limited to a safe value. **Magnetic** element responds instantly to heavy overloads or shorts. Damage is minimized.

***Both* ELEMENTS ARE NEEDED FOR *Complete* PROTECTION!**

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S. A., MEXICO CITY, D.F.

New Prudential building uses FIBERDUCT UNDERFLOOR RACEWAYS for a really modern wiring sy

Highly dramatic, carefully planned, the Prudential Insurance Company's new Wes
now brings another example of modern workability to the Southern California sce
need for a modern, flexible wiring system that matched the workability of the
Wurdeman & Becket, architects, specified a G-E Fiberduct raceway system. This
utilizes approximately 80,000 feet of G-E Fiberduct raceways, and supplies three
rate channels for telephone, signal, and electrical distribution. It provides for
changes as personnel are moved, partitions shifted, and business machines and ph

Tomorrow's electrical demands won't find the new Prudential building wanting. Its system of General Electric Fiberduct underfloor raceways will provide complete electrical flexibility in the years to come. When new outlets are needed, when distribution changes are necessary, this underfloor system can provide these facilities at any time.

General Electric Fiberduct raceways give building management complete freedom of floor arrangement, because they permit the installation of outlets at any point along the duct line—at any time during the life of the building. These non
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lithic or slab and fill typ
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floor area.
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the raceway, pull the
and install the outlet.
on can be added sim-
wires through the
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at low cost with no in-
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